A MICROFAUNA FROM THE MONMOUTH AND BASAL RANCOCAS GROUPS OF NEW JERSEY

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INTRODUCTION

The Monmouth and Rancocas groups of the Upper Cretaceous and Eocene of New Jersey outcrop in a belt striking N 55° E, which extends from the Delaware River near the town of Salem in Salem County to the vicinity of Red Bank and Atlantic Highlands in Monmouth County.

This paper presents the results of a detailed study of the foraminifera and ostracodes of these formations. The identifications which have been made permit a more detailed correlation with the Cretaceous and Eocene standard columns than was heretofore possible.

Little active work has been done on the foraminifera of New Jersey for the last thirty-eight years, and much of this early work is of little use due to the fact that in many cases the forms found were not figured. Practically no work has been done on the Cretaceous and Eocene ostracodes of the northern part of the coastal plain. One short paper was published describing a few species from the Monmouth group of Maryland;[1] a few Eocene forms were described in the Eocene report of the Maryland Survey.[2] Some of these were described as occurring in New Jersey. It has therefore been necessary to rework the ostracodes and foraminifera of this region in order to complete the study of the distribution of Cretaceous and Eocene micro-faunas in North America.

[1]Willard, B. E., Am. Jour. Sci., ser. 5, vol. 9, 1925, pp. 481-487.
[2]Ulrich, E. O. Md. Geol. Surv., Eocene, 1901, pp. 116-122.

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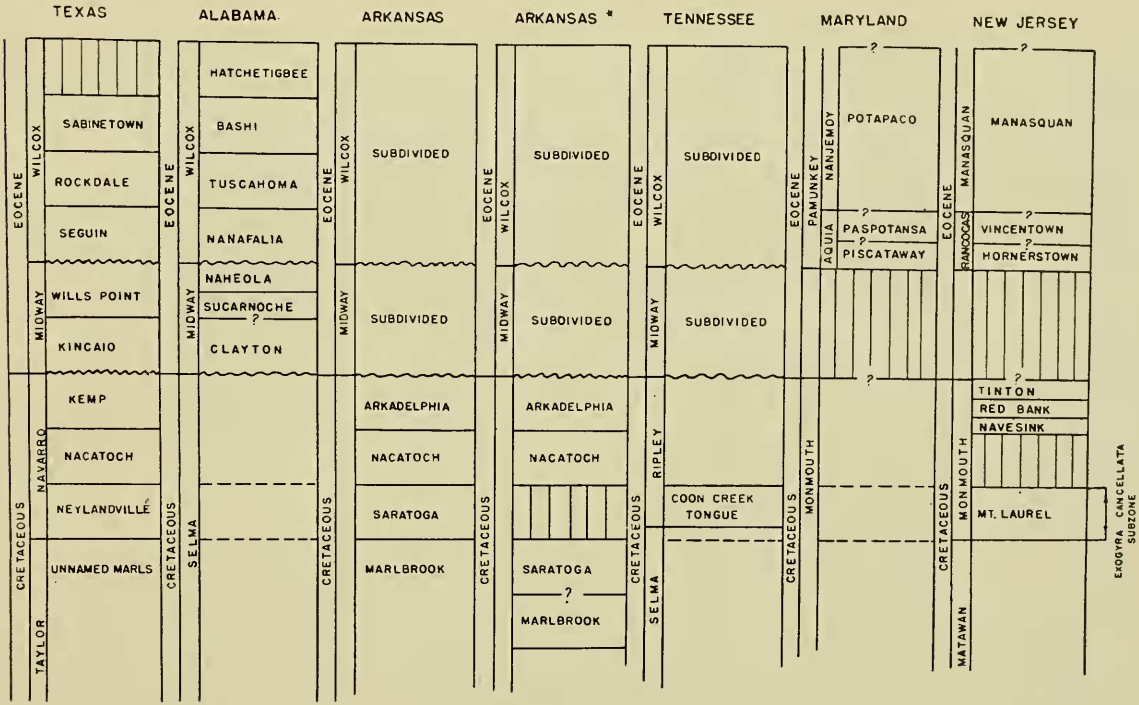
STRATIGRAPHY

That part of the stratigraphic column treated in this paper includes the Mt. Laurel, Navesink, Red Bank, and Tinton formations of the Monmouth group of Cretaceous age, and the Hornerstown formation, the basal formation of the Rancocas group of Eocene age. (See Figure 1.)

The Mt. Laurel consists of from 5 to about 100 feet of quartz sand containing varying amounts of glauconite. The formation thickens to the southeast from its minimum at Atlantic Highlands, reaching its maximum near the center of the state. It is extremely difficult to distinguish the Mt. Laurel from the underlying formation lithologically and to obtain accurate measurements of these beds. A new faunal element is introduced at this point, however, which serves to separate them. The Mt. Laurel is the lowest formation in the *Exogyra costata* zone in New Jersey and in addition forms the *Exogyra cancellata* subzone.

The Mt. Laurel is overlain unconformably by the Navesink formation which consists of from 25 to 40 feet of poorly consolidated sandy glauconitic marl. The glauconite content varies somewhat but the minimum amount appears to exceed the maximum found in the Mt. Laurel. In some localities, as in the road cut at Beers Hill, leaching and weathering has proceeded to a marked degree and the fossils have been largely destroyed or replaced by vivianite; in such places the microfauna has been destroyed. The best preserved microfaunules occur in disconuous shell beds which are fairly common in the Navesink. In

Figure 1



TENTATIVE CORRELATION

Cretaceous correlation modified from Stephenson, Tenn. Geol. Surv., Bull. 41, 1931, p. 14.
*Arkansas Cretaceous from Thomas and Rice, Jour. Pal., vol. 5, 1931, p. 326.
Eocene correlation of Texas and Alabama, W. S. Adkins, Univ. Texas Bull. 3232, 1932, p. 580.
New Jersey and Maryland correlation, Cooke and Stephenson, Jour. Geol., vol. 36, no. 2, 1928, p. 147.

the parts of the formation that do not contain macrofossils the quantity and quality of the microfauna is poor.

The Red Bank formation conformably overlies the Navesink. It consists of from a few inches to 100 feet of reddish to yellow quartz sand with small amounts of glauconite. The exposure of this formation is confined to the northeastern part of the Cretaceous outcrop belt, reaching across the Monmouth County line about one mile north of New Egypt and dying out about one mile to the west of Sykesville in Burlington County. The microfauna in this formation is poorly preserved and no definitely identifiable forms were found in the localities visited. The macrofossils have suffered to the same degree and only poorly preserved molds and casts were found.

The Red Bank is conformably overlain by the Tinton formation which consists of from a few inches to 20 feet of clay, sand, and glauconite. The exposure of the Tinton is confined to the extreme eastern part of the Cretaceous outcrop belt in Monmouth County. The fauna in general seems to be rather similar to the fauna of the Navesink. As a whole the fossils are poorly preserved and no microforms were found.

The Navesink, Red Bank, and the Tinton are overlain unconformably by the Hornerstown which consists of about 30 feet of highly glauconitic sand, with lithology similar to that of the Navesink. The unconformity between the underlying Cretaceous and the Eocene Hornerstown is marked, as the Hornerstown rests on successively older beds as the outcrop is followed towards the southwest, cutting out successively the Tinton, Red Bank, and the upper part of the Navesink. Near the top of the Hornerstown there is a fairly consistent shell bed formed largely of the brachiopod *Terebratula harlani.* The microfauna of this bed is fairly diverse and quite profuse.

LOCALITIES

Mt. Laurel, Nutt's Farm, on Crosswick's Creek, 0.6 mi. north of New Egypt, Ocean Co., New Jersey.
Navesink, Crawford's Corner, about 5 mi., So. of Keyport, New Jersey.
Hornerstown, Tributary to Crosswick's Creek, south of New Egypt.

CORRELATION

The correlation of the Monmouth and Rancocas groups in New Jersey has passed through a variety of phases. The earlier workers all classified these groups as Cretaceous. The lower dividing line was often in dispute, as some of the authors could not differentiate between the Mt. Laurel formation forming the base of the Monmouth group and the Winonah formation which forms the top of the underlying Matawan group. The very marked break between the top of the Monmouth and the base of the Rancocas groups was observed, however, by all the workers. Weller[3] pointed out that the only significant faunal break in the New Jersey "Cretaceous" section was at this point, and it was here that he drew the line between his Ripleyan and Jerseyan divisions. It is probable that if Weller had been more familiar with the Tertiary and Mesozoic faunas he would have realized that the fauna of the Rancocas was definitely Eocene and not Cretaceous. As it was, twenty-one years elapsed before Cooke and Stephenson recognized the Eocene age of this group. At the present time their classification of these beds is accepted.

In 1933 Stephenson[4] recognized the importance of the Mt. Laurel fauna which is characterized by the presence of *Exogyra cancellata*. This fossil sub-zone is confined to the Mt. Laurel formation in New Jersey and has been traced by Stephenson from Atlantic Highlands to Texas.

At the present time there is some discussion regarding the age of the *Exogyra cancellata* zone. In Texas it occupies that portion of the Navarro section below the Nacatoch sand and above the Taylor. The name Neylandville has been suggested for these beds by Stephenson and Adkins.[5]

[3]Weller, S., New Jersey Geol. Surv., Paleontology, vol. 4, Cretaceous Faunas, 1907, pp. 178-179.

[4]Stephenson, L. W., Am. Assoc. Pet. Geol., Bull., vol. 17, no. 11, 1933, pp. 1351-1360.

[5]Adkins, Univ. Texas Bull. 3232, 1932, pp. 488 and 516.

This zone appears to correlate with the Saratoga chalk in Arkansas.[6] In their discussion of the faunas and correlation of the Saratoga, Thomas and Rice[7] point out that its fauna is more closely related to the Taylor fauna than to that of the Navarro. According to these authors this is especially true in respect to the microforms. They list as the typical Taylor forms occurring in the Saratoga, *Gyroidina micheliniana, Heterostomella faveolata, Bolivinoides decorata, Cibicides constricta,* and *Planulina taylorensis.* The only typical Navarro form that Rice and Thomas list as occurring in these beds is *Robulus navarroensis,* and they further state that the representatives of this species found in the Saratoga differ from the specimens found in the Navarro proper. Of the forms listed by these authors as diagnostic of the type Taylor none occurs in the *Exogyra cancellata* zone in New Jersey. Of the thirty-four forms that are listed by Mrs. Plummer[8] as diagnostic of the Taylor in Texas, only two were found in the New Jersey material, namely, *Marssonella oxycona* and *Valvulineria nelsoni.* Of these two, however, the latter is diagnostic of the very top of the Taylor in Texas and the former occurs also in higher beds of undoubted Navarro age in New Jersey. In his report on the Tennessee foraminifera, Cushman[9] lists *Anomalina clementiana* as one of the distinctive species of the fauna of the Coon Creek formation which forms part of the *Exogyra cancellata* zone in that state. He concludes that this fauna is to be placed in the Navarro, somewhere near the Taylor-Navarro contact. This species is very common in the Mt. Laurel formation in New Jersey. Other fossils in the Mt. Laurel listed as diagnostic of the Navarro by Plummer[10] are *Gümbelitria cretacea, Loxostoma plaitum,* and *Dorothia bulletta.* These fossils indicate that the age of the *Exogyra cancellata* zone in New Jersey is Navarro, and the great abundance of *Anomalina*

[6]Dane, C. H., Ark. Geol. Surv., Bull. 1, 1929, p. 111. Stephenson, L. W., Am. Assoc. Pet. Geol., Bull. 11, 1927, p. 15.

[7]Thomas, N. L., and Rice, E. M., Am. Assoc. Pet. Geol., Bull. 15, 1931, p. 996. Thomas, N. L. and Rice, E. M., Jour. Pal., vol. 5, 1931, p. 326.

[8]Plummer, H. J., Univ. Texas Bull. 3501, 1936, p. 282.

[9]Cushman, J. A., Tenn. Geol. Surv., Bull. 41, 1931, p. 15.

[10]Plummer, H. J., Univ. Texas Bull. 3501, 1936, p. 282.

clementiana would indicate that it is equivalent to about the Coon Creek and is therefore lowest Navarro in age.

The Navesink overlies the Mt. Laurel unconformably,[11] though the unconformity is inconspicuous in the field. The correlation of the Navesink with the type section in Texas is a little difficult, due to the fact that there may be an unconformity below the Navarro series in Texas. Stephenson[12] has pointed out that as one proceeds southward from the type section of the Navarro in Navarro County, Texas, the basal members of the Navarro are cut out and, in Travis County in the vicinity of Austin, the *Exogyra cancellata* zone and the Nacatoch are missing. Hence the lowest Navarro of the Austin region is younger than the Nacatoch sand. The Jersey section seems to support the contention of Stephenson, for the Navesink fauna appears to be equivalent to the "basal" Navarro fauna of the Austin region as given by Mrs. Plummer.[13] Of the twenty-eight species that are listed as occurring near Austin, Texas, eighteen are found in the Navesink. Of these *Vaginulina webbervillensis* is given by Cushman[14] as a guide fossil to the *Bulimina* zone of the middle Navarro above the Nacatoch sand. *Bulimina quadrata* is also present in fairly large quantities in the material from the Navesink and though this fossil occurs in other horizons, when present in large numbers it is regarded as an index fossil of the *Bulimina* zone of the middle Navarro.

The two uppermost formations in the Monmouth did not yield any recognizable microfossils. The material was leached to such an extent that none of the smaller forms were preserved in collections made in a number of places in the restricted outcrop area in Monmouth County.

The Hornerstown formation of the Rancocas group is the basal Eocene formation of New Jersey. The fauna of these beds is more or less unique among the Eocene faunas of the United

[11]Stephenson, L. W., op. cit., p. 1360.
[12]Stephenson, L. W., Am. Assoc. Pet. Geol., Bull., vol. 13, 1929, pp. 1331-1332.
[13]Plummer, H. J., Univ. Texas Bull. 3101, 1931, pp. 121-122.
[14]Cushman, J. A., op. cit., p. 14.

States. The only other place where similar faunas occur is in Maryland and as far south as Virginia.[15] The Hornerstown fauna is characterized by the first appearance of *Terebratula harlani* and it is this fossil that Weller[16] regarded as being the most characteristic of his Jerseyan group. This fossil also characterizes the Piscataway stage of the Aquia formation in Maryland[17] with which the Hornerstown formation is now correlated.[18]

The microfauna of the Hornerstown differs from other previously described Eocene microfaunas. It has only five forms that are identical with forms found in the Midway of Texas. These are *Allomorphina "trigonia," Globigerina compressa, G. triloculinoides, Nodogenerina sagrinensis,* and *Pulvinulinella exigua* var. *obtusa.*[19] These species do not appear to be diagnostic of the Midway and several have fairly long ranges. Several of the forms that are found in the Hornerstown, however, show close relationships to forms that are found in the Midway. *Cibicides mortoni,* one of the commonest forms in the Hornerstown, appears to be closely related to *Cibicides alleni* and *C. vulgaris* from the Midway.

Only one faunule has been described from the Wilcox[20] and the exact age of this is difficult to determine as the formation from which it was gathered is not given. The location from which it was collected is not of much aid as the geologic map of Alabama shows several formations outcropping in the immediate vicinity. It appears that the faunule cannot be older than the topmost beds of the Tuscahoma however, and it is probably Bashi or possibly Hatchetigbee in age. The Wilcox faunule has one species in common with the Hornerstown and this is

[15]Weller, S., New Jersey Geol. Surv., Paleontology, vol. 4, Cretaceous Faunas, 1907, p. 179. Md. Geol. Surv., Eocene, 1901, p. 83.
[16]Weller, S., New Jersey Geol. Surv., Paleontology, vol. 4, Cretaceous Faunas, 1907, p. 179.
[17]Maryland Geol. Surv., Eocene, 1901, p. 61.
[18]Cooke and Stephenson, Jour. Geol., vol. 36, no. 2, 1928, pp. 147-148.
[19]Plummer, H. J., Univ. Texas Bull. 2644, 1927, p. 66.
[20]Cushman, J. A., Contrib. Cushman Lab. Foram. Res., vol. 8, 1932, pp. 51-72.

also found in the Midway. It is *Pulvinulinella exigua* var. *obtusa*. There does not appear to be as close a relationship between the faunule described by Cushman and the Hornerstown as there is between the Midway and the Hornerstown. None of the described Claiborne and only one Jackson form were found in the Hornerstown.

In spite of the closer relationship between the Midway and Hornerstown than between the Hornerstown and the described Wilcox fauna, it does not seem that the Hornerstown is Midway in age. The guide fossils to the Midway are missing, and the large number of new species present makes it still more doubtful that the Hornerstown should be Midway in age. It seems most probable that the Hornerstown correlates with the Nanafalia formation of the Wilcox group. This correlation agrees with that made by the Maryland Survey[21] in which it is stated that the Aquia has a closer relationship with the lower Chickasawan or Wilcox than with any other part of the Eocene. This correlation accounts for the similarities of the fauna with that of the Midway and at the same time accounts for the differences between the Hornerstown and the only described Wilcox fauna which would be a good deal younger than the Hornerstown as shown on the accompanying chart. (See Figure 1.)

SYSTEMATIC DESCRIPTIONS

Order FORAMINIFERA d'Orbigny, 1826
Family TEXTULARIIDAE d'Orbigny, 1846
Genus TEXTULARIA Defrance, 1824

Textularia cf. dibollensis Cushman and Applin Pl. 1, figs. 1a-b.
Textularia dibollensis Cushman and Applin, Am. Assoc. Pet. Geol., Bull., vol. 10, 1926, p. 165, pl. 6, figs. 12-14.

This test is rare in the New Jersey Eocene, only one complete specimen having been found. It resembles *T. dibollensis* but has more chambers. In other respects it seems to be the same and is therefore referred to this species. Length, 0.45 mm.; width, 0.25 mm. Hornerstown.

[21]Maryland Geol. Surv., Eocene, 1901, p. 87.

Genus SPIROPLECTAMMINA Cushman, 1927

Spiroplectammina laevis (Roemer) var. **cretosa** Cushman Pl. 1, figs. 2a-b.

Spiroplectammina semicomplanata Plummer, (*non* Carsey) Univ. Texas Bull. 3101, 1931, p. 129, pl. 8, fig. 8 (not fig. 7).

Spiroplectammina laevis (Roemer) var. *cretosa* Cushman, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 87, pl. 11, figs. 3a-b.

The New Jersey forms seem to agree with those shown in fig. 8 by Mrs. Plummer. Cushman has separated these out as a variety of Roemer's species and as distinct from *S. semicomplanata* as originally made by Mrs. Carsey.

Mt. Laurel and Navesink.

Family VERNEUILINIDAE Cushman, 1927

Genus VERNEUILINA d'Orbigny, 1839

Verneuilina bronni Reuss Pl. 1, figs. 3a-b.

Verneuilina bronni Reuss, Verstein. Bohm. Kreide, 1845-46, p. 38, pl. 12 fig. 5; —White, Jour. Pal., vol. 2, 1928, p. 309, pl. 42, figs. 3a-b; —Plummer, Univ. Texas Bull. 3232, 1932, p. 510 (list).

This finely arenaceous and almost equidimensional form appears to be the one identified by Reuss. The material in New Jersey is not well enough preserved to show the sutures and aperture with any great degree of distinctness. Length, 0.50 mm.; width, 0.45 mm. Navesink.

Verneuilina kurti, n. sp. Pl. 1, figs. 4a-b.

Test small, pyramidal, almost equidimensional, triangular in cross-section, margins rounded; early chambers flush, later chambers slightly inflated; early sutures almost invisible, later ones somewhat depressed; wall finely arenaceous, smooth, with much cement; aperture an arched opening in the center of the base of the last chamber. Length, to 0.45 mm.; width, 0.40 mm.

This form differs from *V. bronni* in the greater rounding of the margins and in the inflated character of the later chambers. Also the upper surface and aperture are more arched.

Navesink. Columbia Univ. Coll. No. M 38.

Genus GAUDRYINA d'Orbigny, 1839

Gaudryina rugosa d'Orbigny Pl. 1, fig. 5.

Gaudryina rugosa d'Orbigny, Mem. Soc. Geol. France, vol. 4, 1840, p. 44, pl. 4, figs. 20-21.

Gaudryina pupoides Carsey (*non* d'Orb.), Univ. Texas Bull. 2612, 1926, p. 27, pl. 4, fig. 5.

Gaudryina rugosa Plummer, Univ. Texas Bull. 3101, 1931, p. 135, pl. 8,

fig. 11; —Cushman, Penn. Geol. Surv., Bull. 41, 1931, p. 20, pl. 1, figs. 9-10.

This form appears to be typical of the species. Length, up to 0.80 mm.; width, up to 0.41 mm.

Mt. Laurel and Navesink.

Family VALVULINIDAE Cushman, 1927

Genus CLAVULINA d'Orbigny, 1826

Clavulina insignis Plummer Pl. 1 fig. 6.

Clavulina triquetra Martinotti, (*non* Reuss), Atti. Soc. Ital. Sci. Nat., vol. 64, 1925, p. 177, pl. 4, figs. 8-9.

Tritaxia tricarinata Carsey (*non* Reuss), Univ. Texas Bull. 2621, 1926, p. 27, pl. 6, fig. 4.

Clavulina insignis Plummer, Univ. Texas Bull. 3101, 1931, p. 138, pl. 8, figs. 1-4.

This form appears to be the one Plummer described from Texas. Length, 1.45 mm.; width, 0.35 mm.

Navesink.

Genus ARENOBULIMINA Cushman, 1927

Arenobulimina cuskleyae, n. sp. Pl. 1, fig. 8.

Test subfusiform, apical end pointed, apertural end broadly rounded; test composed of about 4 whorls, the first two rapidly expanding, the last two forming eighty per cent of the test, 4 to 5 chambers to a whorl; spiral suture obliquely depressed, transverse sutures flush, very slightly limbate; test smoothly arenaceous with much cement; aperture virguline, extending from the suture into the septal face which is slightly depressed. Length, 0.95 mm.; width, 0.20 mm.

Hornerstown. Columbia Univ. Coll. No. M 2.

Arenobulimina malkinae, n. sp. Pl. 1, fig. 7.

Test subconical, apical end narrowly rounded, apertural end broadly rounded, chambers 4 to 5 in final whorl, early chambers small, rapidly expanding final whorl forming over half of specimen; wall smoothly arenaceous with much cement; aperture virguline, extending from the suture into the septal face. Length, 0.40 mm.; width, 0.25 mm.

Hornerstown. Columbia Univ. Coll. No. M 1.

Arenobulimina footei, n. sp. Pl. 1, fig. 9.

Test subfusiform, apical end bluntly pointed, apertural end rounded; test composed of about 4 whorls expanding rapidly but

uniformly, 4 chambers to a whorl in mature portion; spiral suture strongly depressed, transverse sutures slightly depressed; aperture broadly virguline, extending into the septal face from the suture; test smoothly arenaceous with much cement. Breadth, 0.30 mm.; length, 0.65 mm.

This form differs from *A. cuskleyae* in that the whorls expand more uniformly instead of the last two being almost equal in size, and the transverse sutures are depressed. It resembles somewhat *A. truncata* (Reuss) but it does not have as many whorls.

Mt. Laurel. Columbia Univ. Coll. No. M 3.

Arenobulimina haffi, n. sp. Pl. 1, fig. 10.

Test suboval, apical end very bluntly pointed, apertural end broadly rounded, test composed of two or three whorls, extremely embracing, last whorl forms more than ninety per cent of test, final chamber one-half of test, four chambers to a whorl; sutures slightly depressed; aperture a very long virguline slit in the flat septal face. Length, 0.70 mm.; width, 0.55 mm.

Mt. Laurel. Columbia Univ. Coll. No. M 4.

Genus MARSSONELLA Cushman, 1933

Marssonella oxycona (Reuss) Pl. 1, figs. 11a-b.

Gaudryina oxycona Reuss, Sitz. Akad. Wiss. Wien, vol. 40, 1860, p. 229, pl. 12, figs. 3a-e; —Cushman, Jour. Pal., vol. 5, 1931, p. 300, pl. 34, figs. 4a-b; —Sandidge, Jour. Pal., vol. 6, 1932, p. 268, pl. 41, figs. 2-3; —Cushman, U. S. Nat. Mus., Pr., vol. 80, art. 14, 1932, p. 18, pl. 5, figs. 1-2

Marssonella oxycona Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, pt. 2, 1933, p. 36, pl. 4, figs. 13a-b.

This form is typical of Cushman's material. Length, to 1.2 mm.; breadth, to 0.50 mm.

Mt. Laurel and Navesink.

Genus DOROTHIA Plummer, 1931

Dorothia bulletta (Carsey) Pl. 1, fig. 12

Gaudryina bulletta Carsey, Univ. Texas Bull. 2612, 1926, p. 28, pl. 4, fig. 4.

Dorothia bulletta Plummer, Univ. Texas Bull. 3101, 1931, p. 132, pl. 8, figs. 13-17.

Agrees with the forms figured by Plummer. Length, 0.70 mm.; thickness, 0.35 mm.

Mt. Laurel and Navesink.

Family LAGENIDÆ Cushman, 1923

Genus ROBULUS Montfort, 1808

Robulus aldrichi Sandidge Pl. 1, fig. 13.

Robulus aldrichi Sandidge, Jour. Pal., vol. 6, 1932, p. 272, pl. 42, figs. 3-4.

This form resembles *Lenticulina degolyeri* Plummer but has a robuline aperture and a more strongly developed rim on the border. Length, 0.70 mm.; thickness, 0.30 mm.; width, 0.60 mm.

Common in Mt. Laurel, rare in Navesink.

Robulus navarroensis (Plummer) Pl. 1, figs. 14a-b.

Cristellaria cultrata Carsey (*non* Montfort), Univ. Texas Bull. 2612, 1926, p. 38, pl. 6, fig. 3.
Cristellaria navarroensis Plummer, Univ. Texas Bull. 2644, 1927, p. 39, figs. 4a-b (in text).
Cristellaria midwayensis Berry and Kelly (*non* Plummer) U. S. Nat. Mus., Pr., vol. 76, art. 19, 1929, p. 7, pl. 1, fig. 3.
Cristellaria orbicularis d'Orb. var. *minuta* Berry and Kelly, loc. cit., p. 8, pl. 1, fig. 2.
Lenticulina navarroensis Plummer, Univ. Texas Bull. 3101, 1931, p. 141.
Robulus navarroensis Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 25, pl. 2, figs. 8a-b.

This form is fairly common in the Mt. Laurel and the Navesink. It agrees with Plummer's forms and shows in general the development of the robuline slit. Diameter, 1 mm. or more.

Robulus hookerae, n. sp. Pl. 1, figs. 15a-b.

Test elongate, compressed, involute, periphery with a sharp delicate keel; six to seven rapidly expanding chambers in the final whorl; sutures limbate, curved, and raised, often showing ridge-like elevations or nodes for a part or all of their length; the sutures join in the center to form an irregular boss or group of node-like protuberances; apertural face laterally bounded by low ridges, aperture at the apex of the apertural face, radiate, with a robuline slit down the apertural face. Length 1.10 mm.; diameter, 0.80 mm.; thickness, 0.60 mm.

A few gerontic specimens have been found in which the tendency to become evolute is marked. The average form is involute in its mature stage.

This form appears to belong to the *R. vicksburgensis* Cushman group; it differs from *R. vicksburgensis* in the rapidity of the expansion of the chambers and in the greater fusing of the septa.

Hornerstown. Columbia Univ. Coll. No. M 15.

Robulus convergens (Bornemann) Pl. 1, fig. 16.

Cristellaria convergens Bornemann Zeitsch. deutsch. geol. Ges., vol. 7, 1855, p. 327, pl. 13, figs. 16-17.
Cristellaria convergens Cushman, Jour. Pal., vol. 1, 1927, p. 152, pl. 23, fig. 12.
Lenticulina ? convergens Cushman and Dusenbury, Contrib. Cushman Lab. Foram. Res., vol. 10, pt. 3, 1934, p. 54, pl. 7, figs. 7a-b.

The lenticuline forms with curved apertural faces appear to belong to this species of Bornemann. Diameter, 0.75 mm.

Mt. Laurel.

Genus LENTICULINA Lamarck, 1804

Lenticulina degolyeri (Plummer) Pl. 1, figs. 17a-b.

Cristellaria degloyeri Plummer, Univ. Texas Bull. 2644, 1927, p. 97, pl. 7, figs. 7a-b.
Lenticulina degolyeri Plummer, Univ. Texas Bull. 3232, 1932, p. 567 (list); —Scott, Geol. Soc. Am., Bull. 45, 1934, p. 1131 (list).

These forms agree with the Midway material described by Plummer. Dr. Scott has pointed out that in addition to being found in the Midway, the form is also found in the Navarro section in Texas. Length, up to 1.20 mm.; width, to 0.85 mm.

Navesink.

Genus MARGINULINA d'Orbigny, 1826

Marginulina costata (Batsch) Pl. 1, fig. 18.

Nautilus (*Orthoceras*) *costatus* Batsch, Conch. des Seesandes, 1791, p. 2, pl. 1, fig. 1.
Marginulina raphanus d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 258, no. 1, pl. 10, figs. 7-8.
Marginulina costata Brady, Challenger Report, vol. 9, 1884, p. 528, pl. 65, figs. 10-13; —Cushman, U. S. Nat. Mus., Bull. 100, vol. 4, 1919, p. 256, pl. 41, figs. 5-8; —Plummer, Univ. Texas Bull. 2644, 1927, p. 107, pl. 5, figs. 8a-c.

Similar to the forms described by Plummer. Length, 0.50 mm. - 1.10 mm.

Mt. Laurel and Navesink.

Marginulina bullata Reuss Pl. 2, fig. 1.

Marginulina bullata Reuss, Verstein. bohm. Kreide, pt. 1, 1845-46, p. 29, pl. 13, figs. 34-38; —Cushman and Jarvis, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 96, pl. 14, figs. 7-8; —U. S. Nat. Mus., Pr., vol. 80, art. 14, 1932, p. 26, pl. 8, figs. 7-8.

Test elongate, rounded in cross-section, composed of a few chambers, early ones coiled, later ones evolute and inflated; sutures depressed in later portion of the test; aperture round, radiate, produced. Length, 0.25-0.55 mm.

Mt. Laurel.

Genus HEMICRISTELLARIA Stache, 1864

Hemicristellaria rancocasensis, n. sp. Pl. 2, fig. 2.

Test elongate, slightly compressed, periphery narrowly rounded; early chambers (4 to 5) coiled, compressed, later chambers (6 to 8) evolute; sutures limbate and raised and curved, sutures in the coiled portion almost as large as the chambers; last two or three chambers inflated in the center, the inflation dying out towards the margins, the sutures showing as narrow transverse ridges in the depressed portion between the inflated portions of the chambers; aperture marginal, radiate, produced. Length, 1.40 mm.; width, 0.50 mm.; thickness, 0.26 mm.

Hornerstown. Columbia Univ. Coll. No. M 12.

Hemicristellaria ensis (Reuss) Pl. 2, fig. 3.

Marginulina ensis Reuss, Verstein. Bohm. Kreid. pt. 1, 1845-46, p. 29, pl. 12, fig. 13; pl. 13, figs. 26-27.
Cristellaria linearа Carsey (*non* d'Orb.) Univ. Texas Bull. 2612, 1926, p. 36, pl. 2, fig .3.
Hemicristellaria ensis Plummer, Univ. Texas Bull. 3101, 1931, p. 146, pl. 10, figs. 1-4.

Test elongate, compressed; first three or four chambers arranged in a distinct coil; later chambers not as compressed as the early ones, oblique to the longitudinal axis; sutures depressed and marked laterally by elongate nodes, which in some forms, in the later chambers, form ridges across the specimen; aperture eccentric, radiate, produced. Length, 1.20 mm.; width, 0.32 mm.

Mt. Laurel.

Genus DENTALINA d'Orbigny, 1826

Dentalina communis (d'Orbigny) Pl. 2, fig. 4.

Nodosaria (*Dentalina*) *communis* d'Orbigny, Ann. Soc. Nat. Sci., vol. 7, 1826, p. 254, No. 35.
Nodosaria (*Dentalina*) *communis* Jones, Parker and Brady, Ann. and Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 158, pl. 9, fig. 46.
Nodosaria communis Carsey, Univ. Texas Bull. 2612, 1926, p. 34, pl. 7, fig. 5.
Dentalina communis Plummer, Univ. Texas Bull., 3101, 1931, p. 149, pl. 11, fig. 4.

Test elongate, curved, tapering with the later chambers inflated, early chambers flush; sutures inclined slightly to axis of the test, in later chambers depressed, early ones shown as dark lines; aper-

ture radiate, eccentric, protruding. Length, 0.75 mm. to 1 mm.

Mt. Laurel and Navesink.

Dentalina confluens Reuss Pl. 2, fig. 5.

Dentalina confluens Reuss, Sitz. d. K. Akad. Wiss. Wien., Bd. 44, no. 21, 1861 (1862), p. 335, pl. 7, fig. 5; —Cushman, Jour. Pal., vol. 5, 1931, p. 304, pl. 35, fig. 1.

Nodosaria confluens Egger, Abh. d. II Cl. d. K. Akad. Wiss., vol. 21, Abth. 1, Munchen, 1899 (1900), p. 72, pl. 9, figs. 27-28.

Fragments of a fairly large dentaline form, with the later chambers inflated and numerous, coarse, rather rounded costae which are somewhat oblique to the longitudinal axis of the test, are fairly common in the Navesink.

Navesink.

Dentalina granti (Plummer) Pl. 2, fig. 6.

Nodosaria filiformis Carsey (*non d'Orb.*) Univ. Texas Bull. 2612, 1926, p. 33, pl. 7, fig. 8.

Nodosaria granti Plummer, Univ. Texas Bull. 2644, 1927, p. 83, pl. 5, fig. 9.

Dentalina granti Plummer, Univ. Texas Bull. 3101, 1931, p. 149, pl. 11, figs. 8-9.

Some fragments of a dentaline form with very elongate and slightly constricted chambers appear to belong to this species.

Mt. Laurel.

Dentalina legumen (Reuss) var. **spirans** Cushman Pl. 2, fig. 7.

Dentalina legumen (Reuss) var. *spirans* Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 28, pl. 3, fig. 2.

Test slender, elongate, tapering and curved; chambers distinct, inflated, initial chamber bearing a short stout spine; sutures distinct, depressed and oblique; aperture round, radiate, extended on a neck; surface ornamented by elongate spiral costae that are continuous from chamber to chamber. Length, up to 1 mm.

Mt. Laurel.

Dentalina nana Reuss Pl. 2, fig. 8.

Dentalina nana Reuss, Sitz. Akad. Wiss. Wien, vol. 46, pt. 1, 1862-63, p. 39, pl. 2, figs. 10-18; —Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 29, pl. 3, fig. 21.

Test elongate, curved, tapering, increasing in size rapidly, diameter greatest towards the apertural end; chambers distinct and of uniform shape; sutures distinct, oblique and depressed;

surface smooth; aperture radiate, eccentric and terminal. Length, to 1 mm.; diameter, 0.20 mm.

Mt. Laurel.

Dentalina raristriata (Chapman)

Nodosaria (*Dentalina*) *raristriata* Chapman, Jour. Roy. Micr. Soc., 1893, ser. 2, vol. 13, p. 591, pl. 9, fig. 4.
Nodosaria intrasegma Carsey, Univ. Texas Bull. 2612, 1926, p. 33, pl. 4, fig. 10.
Dentalina raristriata Plummer, Univ. Texas Bull. 3101, 1931, p. 152, pl. 11, figs. 10-11.

A few fragments with longitudinal costæ across the sutural constrictions and not on the chambers were found in the Navesink. They appear to belong with the forms that were described by Plummer and are referred to this species.

Navesink.

Genus NODOSARIA Lamarck, 1812

Nodosaria fissicostata (Gümbel) Pl. 2, fig. 9

Dentalina fissicostata Gümbel, K. bayer. Akad, Wiss. Munchen, Cl. 2, Abh., vol. 10, 1868-1870, p. 626, pl. 1, fig. 46.
Nodosaria fissicostata Cushman, Contr. Cushman Lab. Foram. Res. vol. 1, 1925, p. 66, pl. 10, fig. 8; Jour. Pal., vol. 1, 1927, p. 154, pl. 24, figs. 10-11; U. S. Geol. Survey., Prof. Pap. 181, 1935, p. 22, pl. 5, figs. 8-9.

Fragmentary tests of a large nodosarian form with a gradually tapering shape are fairly common. The later chambers are inflated; the surface is ornamented with numerous (20 to 25), low, rounded, costæ; the aperture is radiate and produced.

Hornerstown.

Nodosaria latejugata Gümbel var. carolinensis Cushman Pl. 2, fig. 10

Nodosaria latejugata Gümbel var. *carolinensis* Cushman, Contr. Cushman Lab. Foram. Res. vol. 9, 1933, p. 5, pl. 1, fig. 16; U. S. Geol. Surv., Prof. Pap. 181, 1935, p. 21, pl. 5, figs. 10-13.

A number of fragments of a nodosarian form with from 14 to 20 carinæ are found in the Hornerstown. The carinæ are sharp and well developed. The forms appear to be the same as those described by Cushman.

Hornerstown.

Nodosaria paupercula Reuss Pl. 2, fig. 11

Nodosaria paupercula Reuss, Verstein. böhm. Kreide, pt. 1, 1845-46, p. 26, pl. 12, fig. 12;—Cushman, U. S. Nat. Mus., Pr., vol. 80, art. 14, 1932, p. 33, pl. 10, figs. 14-15.

Fragments of a large nodosarian form with from 12 to 17

large sharp costæ are fairly common in the Mt. Laurel. These forms agree with those figured by Cushman, especially with that one shown as fig. 15 in the Proceedings of the U. S. National Museum.

Mt. Laurel.

Nodosaria radicula (Linné) Pl. 2, fig. 12

Nautilus radiculus Linné, Syst. Nat., 12 Ed., 1767, p. 1164, no. 285.
Nodosaria (*Nodosaria*) *radicula* d'Orbigny, Ann. Sci. Nat. vol. 7, 1826, p. 252, Model no. 1.
Nodosaria radicula Brady, Challenger Report, vol. 9, 1884, p. 495, pl. 61, figs. 28-31;—Cushman, U. S. Nat. Mus., Bull. 100, vol. 4, 1919, p. 190, pl. 34; Bull. 71, pt. 3, 1913, p. 52; Bull. 104, pt. 4, 1923, p. 73.
Nodosaria larva Carsey, Univ. Texas Bull. 2612, 1926, p. 31, pl. 2, fig. 2.
Nodosaria radicula Plummer, Univ. Texas Bull. 2644, 1927, p. 77, pl. 4, figs. 9a-b; Bull. 3101, 1931, p. 155, pl. 11, fig. 1;—Sandidge, Jour. Pal., vol. 6, 1932, p. 275, pl. 42, fig. 7.

Test is typical of this species. Length, up to 0.70 mm.; diameter, to 0.20 mm.

Mt. Laurel.

Nodosaria zippei Reuss Pl. 2, fig. 13

Nodosaria zippei Reuss, Geogn, Skizze aus Böhmer, 1844, p. 210; Verstein. böhm. Kreide, pt. 1, 1845-46, p. 25, pl. 8, figs. 1-3.
Nodosaria affinis Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 30, pl. 3, figs. 16-20; Jour. Pal., vol. 5, 1931, p. 305, pl. 35, figs. 2-5; U. S. Nat. Mus., Pr., vol. 80, 1932, art. 14, p. 34, pl. 10, fig. 13.
Nodosaria zippei Plummer, Univ. Texas Bull. 3101, 1931, p. 157;—Sandidge, Jour. Pal. vol. 6, 1932, p. 275, pl. 42, figs. 13-14.

Test large, elongate, uniserial, tapering, 8 or more chambers in a test, initial chamber somewhat larger than the others and bears a large initial spine; sutures constricted in the later stages, almost flush in the early part of the test; surface ornamented with from 10 to 12 sharp longitudinal costæ; aperture round, radiate, and protruding. Length, up to 2.2 mm.

This form appears to be the same one that is described by Cushman and Sandidge. Reuss' figures for *Nodosaria affinis* and for *Nodosaria zippei* seem to show that Sandidge's argument for including these forms in the latter species is correct.

Navesink.

Genus SARACENARIA Defrance, 1824

Saracenaria acutauricularis (Fichtel and Moll) Pl. 2, figs. 14a-b

Nautilus acutauricularis Fichtel and Moll, Test. Micr., (1st Ed. 1798, 2nd Ed. 1803) p. 102, pl. 18, figs. g-i.

Cristellaria acutauricularis Sherborn and Chapman, Roy. Micro. Soc., Jour. Tr. 2nd ser. vol. 6, pt. 2, art. 12, 1886, p. 753, pl. 15, figs. 22a-b.
Saracenaria acutauricularis White, Jour. Pal., vol. 2, 1928, p. 200, pl. 28, fig. 10;—Cushman, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 88, pl. 13, fig. 12.

The New Jersey specimen is a little smaller than those found by White and has two fewer chambers. It agrees, however, in all other respects and is, therefore, assigned to that species. Length, 0.35 mm.; width, 0.27 mm.; thickness, 0.25 mm.

Mt. Laurel.

Genus VAGINULINA d'Orbigny, 1826

Vaginulina webbervillensis Carsey Pl. 2, fig. 15

Vaginulina webbervillensis Carsey, Univ. Texas Bull. 2612, 1926, p. 39, pl. 2, fig. 7;—Cushman, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 27, pl. 4, fig. 14; Tenn. Geol. Surv., Bull. 41, 1931, p. 33, pl. 4, fig. 6;—Moreman, Jour. Pal., vol. 1, 1927, p. 98, pl. 16, fig. 2;—Plummer, Univ. Texas Bull. 3101, 1931, p. 160.

Test large, elongate, compressed, tapering, greatest width close to the apertural end; periphery multicarinate and narrowly rounded, ventral edge straight, dorsal edge curved; chambers numerous, 10 or more in a mature specimen; sutures curved, distinct and limbate, raised in the mature portion of the test; proloculum bulbous and ornamented with strong costæ which extend towards the mature portion of the test, becoming less and less strongly developed and finally only showing at the points where they cross the sutures; aperture round, radiate, protruding, located on the dorsal angle. Length, to 8.0 mm.

This form differs from the typical Texas forms in that the surface of the mature portion of the test is not always smooth as the costations of the proloculum extend as striations over the early mature portion of the test.

Common in the Navesink; rare in the Mt. Laurel.

Vaginulina gracilis var. **cretacea** Plummer Pl. 2, fig. 16

Vaginulina gracilis var. *cretacea* Plummer, Univ. Texas Bull. 2644, 1927, p. 172, pl. 2, fig. 8.

This form agrees with the form illustrated by Plummer and has the sutural nodes which differentiate it from *V. gracilis*. Length, 2.85 mm.; width, about 0.30 mm.

Navesink.

Genus FLABELLINA d'Orbigny, 1839

Flabellina reticulata Reuss Pl. 2, fig. 17

Flabellina reticulata Reuss, Haid. Nat. Abhandl., vol. 4, pt. 1, 1851, p. 30, pl. 1, fig. 22.
Frondicularia reticulata Bagg, U. S. Geol. Surv., Bull. 88, 1898, p. 50, pl. 3, fig. 6.
Frondicularia cf. *interpunctata* Cushman, Am. Assoc. Pet. Geol. Bull., vol. 10, no. 6, 1926, p. 598, pl. 20, fig. 6.
Frondicularia reticulata Plummer, Univ. Texas Bull. 2644, 1927, p. 39, pl. 2, fig. 5.
Flabellina reticulata Franke, Abhandl. Geol., Pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 64, pl. 5, fig. 14;—White, Jour. Pal., vol. 2, 1928, p. 204, pl. 28, fig. 15;—Cushman, Contr. Cushman Lab. Foram. Res., vol. 6, pt. 2, 1930, p. 32, pl. 4, figs. 18-19.

Fragments of this striking reticulate form are found in the Navesink. No whole specimens were recovered.

Navesink.

Genus FRONDICULARIA Defrance, 1826

Frondicularia archiaciana d'Orbigny Pl. 2, figs. 18a-b

Frondicularia archiaciana d'Orbigny, Mem. Soc. Geol. France, ser. 1, vol. 4, 1840, p. 20, pl. 1, figs. 34-36;—Cushman, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 37, pl. 5, figs. 9-12.

Test flabellate in outline, compressed, with a fairly prominent proloculum sometimes with costæ; sutures with the peculiar sigmoid curve which appears to characterize the species.

No whole specimens of this species were found but several fragments were recovered that had the typical sutures.

Navesink.

Frondicularia clarki Bagg Pl. 2, fig. 21

Frondicularia clarki Bagg, Johns Hopkins Univ. Circ., vol. 15, no. 121, 1895, p. 11; U. S. Geol. Surv., Bull. 88, 1898, p. 48, pl. 3, fig. 4.
Frondicularia alata Carsey (*non* d'Orb.) Univ. Texas Bull. 2612, 1926, p. 40, pl. 2, fig. 1.
Frondicularia clarki Cushman, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 34, pl. 5, figs. 1-2;—Plummer, Univ. Texas Bull. 3101, 1931, p. 171, pl. 9, figs. 16, 17.

Test lanceolate in outline, compressed strongly, greatest width slightly below the middle; sutures very slightly raised and slightly limbate; aperture terminal. Length, 1.50 mm.; width 0.50 mm.

This form resembles the one that is illustrated in Plummer's paper on the Cretaceous of Texas.

Navesink.

Frondicularia cuspidata Cushman Pl. 2, figs. 19a-b

Frondicularia cuspidata Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 36, pl. 5, figs. 4-5;—Sandidge, Jour. Pal., vol. 6, no. 3, 1932, p. 278, pl. 42, figs. 16-17.

Test elongate, slender, later part compressed; widest at the base of the last chamber; consists of an elongated proloculum, round in cross-section, tapering to a long spine at the initial end, and from 2 to 4 additional compressed chambers; proloculum ornamented with 5 to 6 longitudinal costæ; lateral margins channeled; sutures distinct, depressed; surface smooth. Length, to 1.35 mm.; width, 0.25 mm.

The New Jersey specimens are larger than those described by Cushman, but the striking proloculum is the same. The New Jersey forms appear to be more mature specimens than those found in Tennessee.

Mt. Laurel.

Frondicularia lanceola Reuss Pl. 2, fig. 20

Frondicularia lanceola Reuss, Sitz. Akad, Wiss. Wien, vol. 40, 1860, p. 168, pl. 5, fig. 1;—Bagg, U. S. Geol. Surv., Bull. 88, 1898, p. 49;—Cushman, Contr. Cushman Lab. Foram. Res. vol. 8, pt. 2, 1930, p. 38, pl. 5, figs. 18-19.

Fragments of a frondicularian form that resemble portions of *Frondicularia lanceola* are fairly common in the Navesink.

Mt. Laurel and Navesink.

Genus LAGENA Walker and Jacob, 1798

Lagena hispida Reuss Pl. 2, fig. 22

Lagena hispida Reuss, Zeit. deutsch. geol. Gesel., vol. 10, 1858, p. 434; Sitz. Akad. Wiss. Wien, Bd. 46, Ab. 1, 1863, p. 335, pl. 6, figs. 77, 79;—Plummer, Univ. Texas Bull. 3101, 1931, p. 159, pl. 10, fig. 12;—Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 37, pl. 5, fig. 6.

Test small, globular, covered with small spines that are evenly distributed over the entire test; aperture at the end of a small tube, often broken. Diameter, 0.22 mm.

Hornerstown.

Lagena sulcata (Walker and Jacob) var. **semiinterrupta** Berry Pl. 2, fig. 23

Lagena sulcata (Walker and Jacob) var. *semiinterrupta* Berry, Berry and Kelly, U. S. Nat. Mus., Pr., vol. 76, art. 19, 1929, p. 5, pl. 3, fig. 19;—Cushman,, Tenn. Geol. Surv., Bull. 41, 1931, p. 37 pl. 5 figs.9-11.

Test small, subglobular, with a slender neck and aperture; surface covered with coalescing costæ, 10 to 15 in number in the

New Jersey specimens; these costæ appear to fuse to a ring at the base. Length, 0.25-0.30 mm.; diameter, 0.12-0.15 mm.

The New Jersey forms resemble those illustrated by Cushman especially that shown in Tenn. Geol. Surv., Bull. 41, pl. 5, fig. 9.

Mt. Laurel and Navesink.

Lagena rostra, n. sp. Pl. 3, figs. 1a-b

Test small, suboval in outline, very slightly compressed; aperture round on a short neck; the sides are ornamented with four keels, the two outer ones being low and regular; the inner ones form flanges which are usually broken; these two fuse together on the neck of the specimen and form one keel on the neck, flanked by the two outer keels. Length, 0.20 mm.; width, 0.16 mm.; thickness, 0.13 mm.

Mt. Laurel and Navesink. Columbia Univ. Coll. No. M 13.

Lagena adepta, new name Pl. 3, fig. 2

Lagena vulgaris Cushman (*non* Williamson), Jour. Pal., vol. 5, no. 4, 1931, p. 308, pl. 35, fig. 11.

Test globular, smooth, with a neck that is shorter than the round portion of the test.

This form appears to agree with the specimen that is figured by Cushman from the Saratoga chalk. The specimen figured by Williamson was elongate, the width being less than a quarter of the length in the type figure.

Mt. Laurel.

Family POLYMORPHINIDÆ d'Orbigny, 1846

Genus GUTTULINA d'Orbigny, 1839

Guttulina hantkeni Cushman and Ozawa Pl. 3, fig. 5

Polymorphina acuta Hantken, (*non* d'Orbigny), A magy. kir. földt. int. erkön. vol. 4, 1875 (1876) p. 51, pl. 8, fig. 4; Mitt. Jahr. K. Ungar. Geol. Anstalt, vol. 4, 1875, (1881), p. 60, pl. 8, fig. 4.
Guttulina hantkeni Cushman and Ozawa, U. S. Nat. Mus., Pr., vol. 77, art. 6, 1930, p. 33, pl. 15, figs. 4-6.

Test oval to botryoidal, more or less rounded at the base, acute at the apertural end; greatest breadth above the middle; chambers ovate, but little embracing, arranged in a counter-clockwise quinqueloculine series, each chamber removed farther from the

base; sutures depressed, distinct; wall smooth and thick; aperture produced and radiate. Length, to 1.50 mm.; breadth, 0.90 mm.

Mt. Laurel and Navesink.

Genus GLOBULINA d'Orbigny, 1839

Globulina lacrima Reuss var. **subsphaerica** (Berthelin) Pl. 3, figs. 6a-b

Polymorphina subsphaerica Berthelin, Mem. Soc. Geol. France, ser. 3, vol. 1, 1880, p. 58, pl. 4, figs. 18a-b.

Globulina lacrima Reuss var. *subsphaerica* Cushman and Ozawa, U. S. Nat. Mus., Pr., vol. 77, art. 6, 1930, p. 78, pl. 19, figs. 5-7;—Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 41, pl. 6, figs. 10a-c.

Test subglobular, slightly compressed, the base broadly rounded, apertural end slightly rounded; chambers few, extending far back towards the base; sides straight; aperture radiate. A few specimens have fistulose apertures. Length, 0.50 mm.; height, 0.45 mm.; thickness, 0.37 mm.

Mt. Laurel.

Genus POLYMORPHINA d'Orbigny, 1826

Polymorphina subrhombica Reuss Pl. 3, fig. 7

Polymorphina subrhombica Reuss, Sitz. Akad. Wiss. Wien. vol. 44, pt. 1, (1861) 1862, p. 339, pl. 7, fig. 3;—Cushman and Ozawa, U. S. Nat. Mus., Pr., vol. 77, art. 6, 1930, p. 114, pl. 30, figs. 1-3.

Test compressed, rhomboidal in adult, rhombic in young, margin angular; chambers broad, not much embracing, alternating; wall smooth and thick; sutures distinct, not depressed; aperture radiate. Length, 1.50-2.50 mm.; width, up to 0.80 mm.

Hornerstown.

Family NONIONIDÆ Reuss, 1860

Genus NONIONELLA Cushman, 1926

Nonionella cretacea Cushman Pl. 3, figs. 3a-b

Nonionella cretacea Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 42, pl. 7, figs. 2a-c.

The largest of these forms is larger than the size given by Cushman, but some of the smaller forms found agree in dimensions. These are fairly rare forms in the New Jersey Cretaceous. Length, up to 0.35 mm.; width, up to 0.24 mm.

Mt. Laurel.

Genus ELPHIDIUM Montfort, 1808

Elphidium cynicalis, n. sp. Pl. 3, figs. 4a-b

Test almost circular, involute, slightly compressed, periphery broadly rounded and somewhat lobulate, umbilical region a little depressed; eight slightly inflated chambers in the final whorl; sutures distinct, depressed, and barely curved; retral processes distinct, 7 to 8 visible in lateral view; wall smooth; aperture a row of small openings at the base of the septal face. Diameter, 0.37 mm.; thickness, 0.20 mm.

This form resembles *Elphidium eocenicum* Cushman and Ellisor from the Jackson of the Gulf Coast. The difference lies in the greater compression shown in the Jackson species; the ratio of diameter to thickness is given as 2½ or 3 to 1, while the New Jersey forms have a ratio of less than 2 to 1.

Hornerstown. Rare. Columbia Univ. Coll. No. M 11.

Family HETEROHELICIDÆ Cushman, 1927

Genus SPIROPLECTOIDES Cushman, 1927

Spiroplectoides emmendorferi, n. sp. Pl. 3, fig. 8

Test minute, compressed; early portion coiled, about nine chambers in the coiled portion; later portion biserial with from two to three sets of chambers in the biserial portion; aperture terminal. Length, 0.18 mm.; width, 0.11 mm.

Hornerstown. Columbia Univ. Coll. No. M 16.

Spiroplectoides rosula (Ehrenberg)

Spiroplecta rosula Ehrenberg, Mikrogeologie, 1854, pl. 32, pt. 2, fig. 26.
Spiroplectoides rosula Cushman and Waters, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 114, pl. 23, figs. 6-7; p. 62, pl. 13, figs. 9a-b;—Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 44, pl. 7, fig. 9; Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 38, pl. 6, figs. 10-13.

This species is very fragile and no complete specimens were found in the New Jersey material, but the numerous fragments were ample to establish the identification. It has been frequently figured and is shown in Cushman's textbook.

Navesink.

Genus GÜMBELINA Egger, 1899

Gümbelina globulosa (Ehrenberg) Pl. 3, fig. 9

Textularia globulosa Ehrenberg, Abhandl. Preuss. Akad. Wiss. Berlin, 1839, p. 135, pl. 4, fig. B.
Gümbelina globulosa Cushman, Jour. Wash. Acad. Sci., vol. 15, no. 6, 1925, p. 134;—White, Jour. Pal., vol. 3, no. 1, 1929, p. 36, pl. 4, fig. 10;—Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 43, pl. 7, figs. 3-5.

Test minute, biserial, V-shaped, tapering uniformly from the initial end; chambers globular, increasing uniformly in size as added, about 4 to 5 pairs of chambers form a test; wall material smooth; aperture an arched opening at the inner margin at the base of the final chamber. Length, 0.17-0.20 mm.; width, 0.11-0.15 mm.

Mt. Laurel and Navesink.

Gümbelina tessera (Ehrenberg) Pl. 3, figs. 10a-b

Grammostomum tessera Ehrenberg, Mikrogeologie, 1854, pl. 32, pt. 2, fig. 18.
Gümbelina tessera Cushman, Jour. Pal., vol. 6, 1932, p. 338, pl. 51, figs. 4-5.

Test minute, biserial, strongly compressed, rhomboidal in front view, chambers uniformly expanding; sutures distinct, depressed, curved; surface of the test smooth; aperture an arched opening at the base of the final chamber. Length, 0.26 mm.; width, 0.18 mm.

This smooth compressed form appears to be the same as that described by Cushman and Ehrenberg. It is rare in the New Jersey sediments.

Navesink.

Gümbelina ultimatumida White Pl. 3, fig. 11

Gümbelina ultimatumida White, Jour. Pal., vol. 3, 1929, p. 39, pl. 4, figs. 13a-b.

Test minute, broadly V-shaped; chambers spherical, the last two very much enlarged, early chambers sometimes faintly striate; aperture a lunate opening at the base of the final chamber. Length, 0.20 mm.; width, 0.12 mm.

The New Jersey specimens are smaller than those found by White in Mexico, but they have the characteristic very large final pair of chambers.

Mt. Laurel.

Genus GÜMBELITRIA Cushman, 1933

Gümbelitria cretacea Cushman Pl. 3, fig. 12

Gümbelitria cretacea Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, pt. 2, 1933, p. 37, pl. 4, figs. 12a-b.

Test minute, triserial throughout, chambers inflated, sub-globular; sutures depressed; aperture a high arched semi-lunar opening at the base of the final chamber. Length, 0.16 mm.; width, 0.10 mm.

This minute form is one of the commonest in the Cretaceous of New Jersey. There is considerable variation in the length-height ratios and it is possible that further study may show that there is more than one species included here.

Mt. Laurel and Navesink.

Genus VENTILABRELLA Cushman, 1928

Ventilabrella carseyae Plummer Pl. 3, figs. 13a-b

Textularia globulosa Carsey (*non* Ehrenberg) Univ. Texas Bull. 2612, 1926, p. 25, pl. 5, figs. 2a-b.

Ventilabrella carseyae Plummer, Univ. Texas Bull. 3101, 1931, p. 178, pl. 9, figs. 7-10;—Sandidge, Am. Mid. Nat., vol. 13, 1932, p. 362, pl. 31, fig. 29.

Test V-shaped, compressed, composed through much of its early development of appressed, inflated, and distinctly striate biserial chambers that increase rapidly in size with growth; later polyserial chambers arranged irregularly in the place of biseriality, forming a mature test that is somewhat fan-shaped in peripheral outline; sutures deeply incised; aperture a broad lunate opening at the base of the septal face in the biserial part of the test, and in the polyserial part the apertures are formed at the base of each chamber.

The megaspheric forms are biserial throughout their development, the polyserial part never developing; their aperture is a broad low lunate slit at the base of the last chamber.

Mt. Laurel and Navesink.

Genus BOLIVINTA Cushman, 1927

Bolivinita crawfordensis, n. sp. Pl. 3, fig. 14

Test small, elongate, cuneiform, compressed; narrow keel of clear shell material running down the center; sutures limbate and raised, formed of clear material, but not raised as high as

central keel; chambers 7 to 8 to a side; aperture elongate slit, often slightly produced. The later chambers in this form are often collapsed. Length, 0.25 mm.; width, 0.14 mm. Type broken.

Hornerstown. Columbia Univ. Coll. No. M5.

Genus EOUVIGERINA Cushman, 1926

Eouvigerina hispida Cushman Pl. 3, fig. 15

Eouvigerina hispida Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 45, pl. 7, figs. 12-13.

This form appears to be the same as the one that Cushman illustrates in the Tennessee Bulletin though it lacks the initial spine which is shown in one of the views and not in the other. Length, 0.25 mm.; width, 0.17 mm.

Mt. Laurel.

Genus PSEUDOUVIGERINA Cushman, 1927

Pseudouvigerina triangularis, n. sp. Pl. 3, figs. 16a-b

Test small, elongate, triangular in cross-section with the species truncated by a curved surface; greatest width well above the middle; early chambers appear to be biserial, later chambers triserial, inflated, distinct; sutures distinct, depressed, and strongly curved in the latter part of the test; surface of the test finely perforate; aperture terminal, ovate, and with a slight lip. Length, up to 0.45 mm.; width, 0.25 mm.

The ratio of length to width varies considerably in this species. It has some resemblance to *P. cretacea* Cushman but is not coarsely perforate and the margins are not as round. The aperture has not the tooth described in *P. plummerae* Cushman nor is the margin as angulate.

Hornerstown. Columbia Univ. Coll. No. M37.

Genus NODOGENERINA Cushman, 1927

Nodogenerina sagrinensis (Bagg) Pl. 3, fig. 17

Nodosaria sagrinensis Bagg, U. S. Geol. Surv., Bull. 513, 1912, p. 58, pl. 16, fig. 4;—Plummer, Univ. Texas Bull. 2644, 1927, p. 85, pl. 4, fig. 16.

Fragments of a straight uniserial form with strongly inflated, slightly pyriform chambers, the upper parts of which carry close lying spines which do not extend to the base of the chambers and therefore impart an obscure angulation to the outline of the test;

aperture round, flaring, with a slight lip.

These imperfect forms appear to be the same as those described by Plummer and by Bagg. The chambers are not as pyriform as the ones illustrated in the Texas Bulletin, but they are close to them and may be classified in the same species.

Hornerstown.

Family BULIMINIDÆ Jones, 1876

Genus BULIMINELLA Cushman, 1911

Buliminella fusiforma, n. sp. Pl. 3, fig. 18

Test fusiform, initial end pointed, apertural end rounded; about three whorls to a test, the last forming 80 per cent of the test; four chambers to a whorl; sutures distinct, depressed, spiral suture much more strongly depressed than transverse; aperture virguline, in a depression in the septal face forming a strong angle with the axis of the test. Length, 0.21-0.32 mm.; width, 0.18 mm.

Navesink. Columbia Univ. Coll. No. M7.

Genus BULIMINA d'Orbigny, 1826

Bulimina quadrata Plummer Pl. 3, fig. 19

Bulimina quadrata Plummer, Univ. Texas Bull. 2644, 1927, p. 72, pl. 4, figs. 4-5.

Bulimina pupoides Carsey (*non* d'Orb.), Univ. Texas Bull. 2612, 1926, p. 29, pl. 4, fig. 3;—Plummer, Univ. Texas Bull. 3101, 1931, p. 180, pl. 9, fig. 15;—Sandidge, Jour. Pal., vol. 6, 1932, p. 280, pl. 43, fig. 1.

Bulimina obtusa Cushman (*non* d'Orb.), Tenn. Geol. Surv., Bull. 41, 1931, p. 47, pl. 7, figs. 17-18; Jour. Pal., vol. 5, 1931, p. 309, pl. 35, figs. 15a-b.

Bulimina quadrata Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 11, 1935, p. 100, pl. 15, figs. 12-16.

Test elongate the greatest width towards the apertural end; initial end rounded, apertural end more so; chambers numerous and slightly inflated, triserial, later sutures distinct and slightly depressed; wall smooth; aperture curved and virguline, bearing in the well preserved specimens a plate-like tooth. Length, 0.55 mm.; width, 0.20 mm.

This form appears to be the same as 13a figured by Cushman and Parker. It also resembles the specimens from the Navarro. There is some variation in the ratio of the length to the height and in the degree of inflation of the chambers.

Navesink; rare in Mt. Laurel.

Bulimina reussi Morrow Pl. 3, fig. 20

Bulimina ovulum Reuss (*non ovula* d'Orb.), Verstein, Bohm. Kreide, pt. 1, 1845, p. 37, pl. 8, fig. 57; pl. 13, fig. 73.
Bulimina murchisoniana Cushman (*non* d'Orb.), Jour. Pal., vol. 5, 1931, p. 309, pl. 35, figs. 14a-b; vol. 6, 1932, p. 340.
Bulimina reussi Morrow, Jour. Pal., vol. 8, 1934, p. 195, pl. 29, fig. 12;—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 11, 1935, p. 99, pl. 15, figs. 8a-b, 10.

Test small, fusiform, initial end pointed, apertural end broadly rounded; about four whorls with three or four chambers to a whorl; surface smooth; sutures distinct, slightly depressed; aperture virguline, situated in a slight depression at the base of the septal face. Length, 0.25 mm.; width, 0.15 mm.

Navesink.

Bulimina referata, n. sp. Pl. 3, figs. 21a-b

Test minute, elongate, triangular in cross-section; four or more whorls, three chambers to a whorl; chambers short; sutures distinct, depressed; wall smooth; aperture virguline and fairly large. Length, from 0.15-0.25 mm.; width, 0.09-0.15 mm.

Mt. Laurel and Navesink. Columbia Univ. Coll. No. M6.

Genus NEOBULIMINA Cushman and Wickenden, 1928

Neobulimina canadensis Cushman and Wickenden Pl. 3, fig. 22

Neobulimina canadensis Cushman and Wickenden, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 13, pl. 1, figs. 1-2;—Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 48, pl. 8, figs. 1a-c.

Test small, elongate, about 2½ times as long as wide, early portion triserial, later portion biserial, each part forming about ½ the test; chambers inflated and subglobular, about 12 to 15 chambers in triserial part, 4 in the biserial portion; sutures distinct, depressed; aperture a long V-shaped opening at the base of the apertural face and extending upwards in the plane of biseriality. Length, 0.30 mm.; width, 0.12 mm.

Navesink.

Genus LOXOSTOMA Ehrenberg, 1854

Loxostoma plaitum (Carsey) Pl. 3, fig. 23

Bolivina plaita Carsey, Univ. Texas Bull. 2612, 1926, p. 26, pl. 4, fig. 2.
Proporus plaita Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, p. 89, pl. 12, fig. 7.

Loxostomum plaitum Cushman, Foram. Class., 1928, pl. 37, fig. 9; Tenn. Geol. Surv., Bull. 41, 1931, p. 51, pl. 8, fig. 9.
Loxostoma plaitum Plummer, Univ. Texas Bull. 3101, 1931, p. 182, pl. 10, figs. 5-7.

These New Jersey forms are typical of this species. Length, 0.80 mm.; width, 0.18 mm.

Mt. Laurel and Navesink.

Genus UVIGERINA d'Orbigny, 1826

Uvigerina seligi Cushman Pl. 3, fig. 24

Uvigerina seligi Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, 1925, p. 1, pl. 4, figs. 1a-c.
Uvigerina tenuistriata Carsey (*non* Reuss), Univ. Texas Bull. 2612, 1926, p. 42, pl. 1, fig. 1.
Uvigerina seligi Plummer, Univ. Texas Bull. 3101, 1931, p. 186, pl. 14, fig. 10.

"Test small, average specimen about twice as long as broad, the last two whorls comprising most of the test; chambers marked by two longitudinal and faintly beaded costæ that give the appearance of bicarination to each of the three longitudinal series of chambers which strongly overlap; sutures between later mature chambers depressed, giving a distinctly lobate outline to the test; aperture a short cylindrical neck and phialine lip. Length, 0.30 mm.; width, 0.15 mm."

Mt. Laurel and Navesink.

Family ROTALIIDÆ Reuss, 1860

Genus VALVULINERIA Cushman, 1926

Valvulineria nelsoni (Berry) Pl. 4, figs. 1a-b

Anomalina nelsoni Berry, U. S. Nat. Mus., Pr., vol. 76, art. 19, 1929, p. 14, pl. 2, figs. 19-21.
Anomalina involuta Cushman (*non* Reuss), Tenn. Geol. Surv., Bull. 41, 1931, p. 60, pl. 12, fig. 1.
Valvulineria ripleyensis Sandidge, Jour. Pal., vol. 6, 1932, p. 281, pl. 43, figs. 4-6.
Cibicides nelsoni Plummer, Univ. Texas Bull. 3501, 1936, p. 288, pl. 5, figs. 1-6.

Test subcircular, biconvex, more convex on the ventral than on the dorsal side, periphery broadly rounded, often lobulate; chambers numerous, 6 to 8 in the final whorl, rapidly expanding as added, final 2 to 3 chambers usually inflated; sutures distinct, curved, and later ones impressed; aperture an elongate slit at the base of the final chamber, extending from the periphery to the

umbilicus, covered in well preserved specimens by a delicate triangular flap. Diameter, up to 0.53 mm.

These figures were made from two specimens as the umbilical flap is not preserved in good condition in most specimens.

Mt. Laurel and Navesink.

Genus GYROIDINA d'Orbigny, 1826

Gyroidina soldani d'Orbigny Pl. 4, figs. 2a-b

Gyroidina soldani d'Orbigny, Ann. Sci. Nat. VII, 1826, p. 278, fig. 5, Modèle No. 36.
Rotalia soldani Parker, Jones and Brady, Ann. Mag. Nat. Hist., ser. 3, vol. 16, 1865, p. 25, pl. 3, fig. 86.
Gyroidina soldani Galloway and Morrey, Bull., Am. Pal., vol. 15, no. 55, 1929, p. 27, pl. 4, fig. 4.

Test small, subcircular in outline, planoconvex, dorsal side almost flat, ventral side strongly convex with a deep umbilicus; chambers 8 to 10 in the final whorl, spiral suture often deeply depressed; transverse sutures straight; aperture a slit at the base of the final chamber, extending from the periphery to the umbilicus. Diameter, up to 0.40 mm.

Mt. Laurel, Navesink and Hornerstown.

Genus SIPHONINA Reuss, 1850

Siphonina prima Plummer Pl. 4, figs. 3a-b

Siphonina prima Plummer, Texas Univ. Bull. 2644, 1927, p. 148, pl. 12, figs. 4a-c;—Cushman, U. S. Nat. Mus., Pr., vol. 72, art. 20, 1927, p. 2, pl. 2, figs. 4a-c.

Test nearly circular, slightly compressed, almost equally biconvex; periphery sharp, slightly lobulate and serrate; chambers 5 to 6 in the final whorl and very slightly inflated; sutures distinct and curved obliquely on the dorsal side, nearly radial on the ventral, the serrate edges of the chambers are preserved along the sutures in the best material; surface of the test punctate, aperture an elliptical slit-like opening close to the periphery on the ventral side of the final chamber. Diameter, 0.16-0.22 mm.

Navesink.

Family CASSIDULINIDÆ d'Orbigny, 1839

Genus PULVINULINELLA Cushman, 1926

Pulvinulinella exigua (Brady) var. **obtusa** (Barrows and Holland) Pl. 4, figs. 4a-b

Pulvinulina exigua Brady var. *obtusa* Burrows and Holland, Geol. Assoc., Pr., vol. 15, 1897, p. 49, pl. 2, fig. 25;—Plummer, Univ. Texas Bull. 2644, 1927, p. 151, pl. 11, figs. 2a-c.

Pulvinulinella exigua (Brady) var. *obtusa* (Burrows and Holland) Cushman and Ponton, Contr. Cushman Lab. Foram. Res., vol. 8, pt. 3, 1932, p. 71, pl. 9, figs. 9a-c.

Test subcircular, biconvex, 5 to 6 chambers in final whorl; sutures on dorsal side straight, ventral sutures obliquely radial; aperture found in a depressed area on the septal face; part of the aperture extends in a direction parallel to the place of coiling of the test and just ventral to the periphery, meeting at an angle the second portion of the aperture which extends vertically almost to the umbilical region at the base of the septal face. Length, 0.45 mm.; width, 0.20 mm.

Hornerstown.

Family CHILOSTOMELLIDÆ Brady, 1881

Genus ALLOMORPHINA Reuss, 1850

Allomorphina halli, n. name Pl. 4, figs. 5a-b

Allomorphina trigona Plummer (*non* Reuss), Univ. Texas Bull. 2644, 1927, p. 129, pl. 8, figs. 5a-b.

Test bluntly triangular in outline; biconvex, slightly compressed; periphery broadly rounded, chambers few, 3 or 4 in the final whorl; sutures depressed, shell wall thin, smooth; aperture a slit beneath a flap at the base of final chamber on the ventral side. Diameter, 0.35 mm.; thickness, 0.23 mm.

Hornerstown.

Genus PULLENIA Parker and Jones, 1862

Pullenia quinqueloba (Reuss) Pl. 4, figs. 6a-b

Nonionina quinqueloba Reuss, Zeitschr. deutsch Geol. Gesell., vol. 5, 1851, p. 71, pl. 5, fig. 31.

Pullenia quinqueloba Brady, Challenger Report, vol. 9, 1884, p. 617, pl. 84, figs. 14-15;—Cushman and Church, Cal. Acad. Sci., Pr., ser. 4, vol. 18, 1929, p. 517, pl. 41, figs. 10-11;—Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 57, pl. 10, figs. 4a-b; Jour. Pal., vol. 5, 1931, p. 313, pl. 36, figs. 3a-b;—Cushman and Jarvis, U. S. Nat. Mus., Pr., vol. 80, art. 14, 1932, p. 49, pl. 15, figs. 4a-b.

Test planispiral, involute, compressed; periphery rounded, slightly lobulate; usually five chambers in the final whorl, in-

creasing in size as added; sutures distinct, depressed and almost straight; wall smooth; aperture an elongate slit at the base of the last chamber; Mt. Laurel and Navesink. Diameter, 0.25-0.45 mm.; thickness, 0.15-0.25 mm.

Family GLOBIGERINIDÆ Cushman, 1927

Genus GLOBIGERINA d'Orbigny, 1826

Globigerina bulloides d'Orbigny Pl. 4, fig. 7

Globigerina bulloides d'Orbigny, Ann. Sci. Nat., 1826, vol. 7, p. 277, Modèles 17 and 76;—Cushman, U. S. Nat. Mus., Bull. 71, pt. 4, 1914, p. 5, pl. 2, figs. 7-9.

This form with four chambers in the final whorl, an aperture from all the chambers opening into umbilicus, and a reticulated surface, appears to agree with the descriptions and figures as shown by d'Orbigny.

Hornerstown.

Globigerina compressa Plummer Pl. 4, fig. 8

Globigerina compressa Plummer, Univ. Texas Bull. 2644, 1927, p. 135, pl. 8, figs. 11a-c.

Test trochoid, compressed, about equally biconvex; periphery narrowly rounded, lobulate; two whorls visible on the dorsal side, five chambers in the final whorl, somewhat inflated; sutures depressed and curved; aperture extending from periphery to the umbilicus, a narrow flap projects over the aperture. Diameter, 0.35 mm.

Hornerstown.

Globigerina cretacea d'Orbigny Pl. 4, fig. 9

Globigerina cretacea d'Orbigny, Mem. Soc. Geol. France, 1840, p. 34, pl. 3, figs. 12-14;—Cushman, Contr. Cushman Lab. Foram. Res., vol. 7, pt. 2, 1931, p. 44, pl. 6, figs. 6a-c; Tenn. Geol. Surv., Bull. 41, 1931, p. 58, pl. 10, figs. 6-7.

Test low trochoid, subcircular in outline, five chambers in the final whorl; surface spinose; aperture ventral, opening into large umbilical area which is sometimes covered by a thin plate. Diameter, 0.30 mm.

Mt. Laurel and Navesink.

Globigerina triloculinoides Plummer Pl. 4, fig. 10

Globigerina triloba Egger (*non* Reuss), Abh. k. bay. Akad. Wiss. Cl. 2, vol. 21, pt. 1, (1899) 1900, p. 171, pl. 21, fig. 8.

Globigerina triloculinoides Plummer, Univ. Texas Bull. 2644, 1927, p. p. 134, pl. 8, figs. 10a-c.

Test small, trochoid, about 2 to 2½ whorls visible on dorsal side, 3½ chambers to a whorl, chambers strongly inflated and rapidly enlarging, periphery broadly rounded and lobate; shell surface strongly reticulate; aperture extends from near periphery to shallow umbilical depressed area; it is protected by a flap. Diameter, 0.25 mm.

This is a rare form in the Hornerstown, only one whole specimen having been found. It appears to agree with the form that Plummer described from the Midway.

Hornerstown.

Genus GLOBIGERINELLA Cushman, 1927

Globigerinella aspera (Ehrenberg) Pl. 4, fig. 11

Phanerostomum asperum Ehrenberg, Mikrogeologie, 1854, pl. 30, figs. 26a-b; pl. 32, pt. 2, fig. 42.
Globigerina aspera Egger, Abhandl. kon. bay. Akad. Wiss. Munchen, Cl. 2, vol. 21, pt. 1, 1899, p. 170, pl. 21, figs. 18-20.
Globigerinella aspera Carman, Jour. Pal., vol. 3, 1929, p. 315, pl. 34, fig. 6;—Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 59, pl. 11, figs. 5a-b.

Test almost planispiral, consisting of from 5 to 7 gradually enlarging chambers in the final whorl; periphery rounded; surface spinose and roughened; aperture an arched slit at the base of the final chamber, embracing the periphery. Diameter, 0.35-0.40 mm.

Mt. Laurel and Navesink.

Globigerinella voluta (White) Pl. 4, fig. 12

Globigerina aequilateralis Chapman, Quart. Jour. Geol. Soc. London, vol. 48, 1892, p. 517, pl. 15, fig. 14;—Chapman (*non* Brady), Quart. Jour. Roy. Micro. Soc. London, 1896, p. 589, pl. 13, fig. 7.
Globigerina voluta White, Jour. Pal., vol. 2, 1928, p. 197, pl. 28, fig. 5.
Globigerinella voluta Sandidge, Jour. Pal., vol. 6, 1932, p. 284, pl. 44, figs. 1-2.

Test almost planispiral, loosely coiled, consisting of about 1½ coils of from 4 to 6 rapidly expanding chambers in the final whorl; chambers inflated, sutures depressed; wall somewhat spinose; aperture an arched slit embracing the periphery at the base of the final chamber. Diameter, 0.35 mm.

The rapidly expanding chambers and their fewer number to a coil, together with the smoother surface serve to separate this

form from *G. aspera.*

Mt. Laurel and Navesink.

Family GLOBOROTALIIDÆ Cushman, 1927

Genus GLOBOTRUNCANA Cushman, 1927

Globotruncana fornicata Plummer Pl. 4, fig. 13

Globotruncana fornicata Plummer, Univ. Texas Bull. 3101, 1931, p. 198, pl. 13, figs. 4-6.

A few forms with narrower chambers and more strongly curved dorsal sutures than those found in *Globotruncana arca* occur in the Mt. Laurel. These forms seem to be the same as those described by Mrs. Plummer as *Globotruncana fornicata.* Diameter, 0.35 mm.

Mt. Laurel.

Globotruncana arca (Cushman) Pl. 4, figs. 14a-b

Globigerina canaliculata Egger (*non* Reuss), Abh. k. bayer. Akad. Wiss. Cl. 2, vol. 21, 1899, p. 172, pl. 21, figs. 24-26.
Globigerina rosetta Carsey, Univ. Texas Bull. 2612, 1926, p. 44, pl. 5, fig. 3;—Plummer, Univ. Texas Bull. 2644, 1927, p. 172, pl. 2, fig. 9.
Pulvinulina arca Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 23, pl. 3, fig. 1.
Globotruncana arca Moreman, Jour. Pal., vol. 1, 1927, p. 100, pl. 16, figs. 16-17.
Globotruncana rosetta White, Jour. Pal., vol. 2, 1928, p. 286, pl. 39, fig. 1.
Globotruncana arca Plummer, Univ. Texas Bull. 3101, 1931, p. 195, pl. 13, figs. 7-9, 11.

Typical of the species. Diameter, 0.70 mm.

Mt. Laurel and Navesink.

Family ANOMALINIDÆ Cushman, 1927

Genus ANOMALINA d'Orbigny, 1826

Anomalina pinguis, n. name Pl. 5, fig. 1

Anomalina grosserugosa Plummer, Univ. Texas Bull. 3101, 1931, p. 201, pl. 14, fig. 9.

Test nearly equally biconvex, ventral face slightly more convex, coarsely punctate, completely involute on ventral, almost so on dorsal, periphery broadly rounded, chambers 8 to 9 in final whorl, later chambers distinctly inflated, suture depressed between last few chambers, limbate in early chambers; sutures slightly curved; aperture at base of septal face embracing the margin.

Diameter, 0.50 mm.; thickness, 0.25 mm.

This form differs from the type in being less compressed and less lobulate.

Mt. Laurel and Navesink.

Anomalina clementiana (d'Orbigny) Pl. 5, figs. 2a-c

Rosalina clementiana d'Orbigny, Mem. Soc. Geol. France, ser. 1, vol. 4, 1840, p. 37, pl. 3, figs. 23-25.
Anomalina clementiana Franke, Abhandl. Geol. Pal. Instit. Univ. Greifswald, vol. 6, 1925, p. 85, pl. 7, figs. 12a-c.
Anomalina tennesseensis Berry, Berry and Kelly, U. S. Nat. Mus., Pr., vol. 76, art. 19, 1929, p. 13, pl. 2, figs. 13-15.
Anomalina clementiana Cushman, Tenn. Geol. Surv., Bull. 41, 1931, p. 61, pl. 13, figs. 1a-c.

Test tending towards the planispiral, strongly compressed, periphery narrowly rounded; chambers distinct, generally from 7 to 9 in final whorl, few forms with 10 chambers; dorsal side slightly arched, ventral side depressed towards the center; sutures strongly limbate, curved, and raised on the dorsal side, in some few forms the final suture may be depressed between the last chambers; on the ventral side the sutures are depressed and curved, the inner ends of the chambers raised between them; aperture peripheral and extending onto the ventral side. Diameter, 0.25-0.37 mm.; thickness, 0.10-0.12 mm.

Mt. Laurel.

Genus CIBICIDES Montfort 1808

Cibicides mortoni (Reuss) Pl. 5, figs. 3a-c

Rotalia mortoni Reuss, Sitz. Akad. Wiss. Wien, vol. 44, (1861) 1862, p. 337, pl. 8, figs. 1a-c.

Test subcircular, biconvex, dorsal surface usually less convex than ventral, dorsal surface shows a considerable growth of secondary tissue in the center; the ventral surface is slightly umbilicate in some specimens; periphery bluntly angled; chambers 9 to 10 in the final whorl in mature forms; the early chambers may be masked by the growth of tissue on the dorsal side; early sutures on the dorsal side flush and inclined to be a little limbate,

later sutures simple and depressed in the mature forms; sutures on the ventral curved and depressed; wall puncate; aperture an arched opening embracing the periphery and extending along the spiral suture below the final chamber or last two chambers; sometimes the aperture may carry a small lip. Diameter, up to 1 mm.; thickness, up to 0.35 mm.

This appears to be the same form that Reuss illustrated from New Jersey. It is one of the commonest forms in the Hornerstown formation.

Hornerstown.

Cibicides neelyi, n. sp. Pl. 5, figs. 4a-c.

Test planoconvex, dorsal side flat to slightly depressed, ventral side convex with an umbo of clear shell material; periphery narrowly rounded; 8 to 9 chambers in the final whorl which is strongly embracing; sutures on the dorsal side curved, limbate, and raised in the earlier part of the whorl, becoming simple and depressed in the later chambers; sutures on the ventral side are curved and limbate in the earlier part of the whorl, becoming simple and depressed in the later part as do the dorsal sutures; the earlier sutures are often masked by growth of secondary tissue; surface of the test strongly punctate; aperture an arched opening embracing the periphery and extending dorsally beneath the final chamber. Diameter, up to 0.65 mm.; thickness, up to 0.25 mm.

This is a very variable species in outline and in the behavior of the sutures, some of which in the earlier part of the whorl do not reach the periphery.

Hornerstown. Columbia University Coll. No. M10.

Cibicides burlingtonensis, n. sp. Pl. 5, figs. 5a-c

Test planoconvex, compressed, dorsal flat to slightly concave, ventral side convex, test completely embracing on ventral side and almost so on dorsal; chambers 5 to 6 in the final whorl, rapidly enlarging, sutures depressed and strongly curved, curvature increasing towards periphery; surface perforate; aperture an arched slit at the periphery extending onto the dorsal side below

the first chamber. Diameter, 0.37 mm.; thickness, 0.10 mm.

Hornerstown. Columbia University Coll. No. M9.

Cibicides padella, n. sp. Pl. 5, figs. 6a-b.

Test planoconvex, dorsal side flat or very slightly arched; only last whorl visible, early whorls concealed by thickening of secondary tissue at center; ventral side convex, almost conical with loss of clear shell material at the center, periphery acute, usually formed by blunt keel; chambers 10 to 12 in the final whorl, gradually increasing in size as added; sutures on the dorsal distinct, limbate and curved, fusing on the periphery to form the keel; on the ventral the sutures, especially the later ones, are depressed; surface coarsely perforate, aperture peripheral, extending on the dorsal side and backward along the spiral suture for the length of one or two chambers. Diameter, 0.22-0.32 mm.; thickness, 0.11-0.16 mm.

Navesink. Columbia University Coll. No. M8.

Order OSTRACODA Latreille

Suborder PLATYCOPA Sars

Family CYTHERELLIDÆ Sars, 1865

Genus CYTHERELLA Jones, 1849

Cytherella moremani Alexander Pl. 6, fig. 1

Cytherella moremani Alexander, Univ. Texas Bull. 2907, 1929, p. 53, pl. 1, figs. 4-5.

Carapace ovate, inequivalved; greatest height at or close to the middle; dorsal margin arched with the anterior slope flatter and straighter than the posterior; anterior end broadly and evenly rounded; ventral margin evenly convex; posterior margin more narrowly rounded than the anterior and obscurely angled at about the center.

Right valve overlaps the left on the entire contact; overlap greater at center of the dorsal margin and along the ventral border; overlap of the posterior margin less than the anterior margin.

Maximum thickness of the males located slightly posterior to the center, in the females close to the posterior margin. Length, 0.77 mm.; height, 0.51 mm.; thickness, 0.35 mm.

This form, though generally smaller than the form described by Alexander, preserves the same proportions and in other respects resembles the forms that were obtained from the Navarro.

Navesink.

Genus CYTHERELLOIDEA Alexander, 1929

Cytherelloidea monmouthensis, n. sp. Pl. 6, fig. 4

Carapace small, compressed, oblong, ovate in lateral view; dorsal margin straight; anterior margin broadly rounded; ventral margin gently convex to almost straight; posterior margin more narrowly rounded than anterior.

A narrow ridge parallels the entire margin; it is most strongly developed on the anterior margin, and is well developed on the dorsal and posterior margins; on the ventral margin the development of the ridge weakens from the anterior towards the posterior margins until it almost disappears at the posterior ventral contact. Two ridges emerge from the curvature of the valves, one opposite the antero-ventral contact and another opposite the antero-dorsal, and each extends posteriorly parallel to its adjacent dorsal or ventral margins and close to the marginal ridge; the dorsal ridge merges with the curvature of the valve and the ventral ridge ends in a tubercle. A broad shallow pit is located just ventral to the center of the valves between the two inner ridges, and is so close to the ventral one of these that it appears to bend around it. Length, 0.47 mm.; height, 0.30 mm.; thickness, 0.18 mm.

This form differs from *C. williamsoniana* in having but one tubercle and a complete marginal ridge.

Navesink. Columbia University Coll. No. M17.

Cytherelloidea navesinkensis, n. sp. Pl. 6, fig. 3

Test small, suboblong, compressed; dorsal margin gently arched; anterior margin broadly rounded; ventral margin straight; posterior margin more narrowly rounded than anterior.

A ridge parallels the anterior margin at a short distance from the contact, dying out dorsally and ventrally; a deep groove lies just posterior to and parallel with the anterior marginal ridge; a

heavy undular ridge runs subparallel to the posterior margin being in contact with it at its dorsal and ventral extremities and leaving a narrow flattened area at the center. A curved ridge extends about parallel to the ventral border from opposite the anterior to opposite the posterior ventral contact. A curved groove on the dorsal side of this ridge separates it from a roughly oval bifurcating ridge, enclosing a broad shallow oval pit located just dorsal to the center; the dorsal half of this ridge curves close to the dorsal margin in the mid part of its course, swinging in a ventral direction to meet the ventral part of the ridge and dying out in the anterior region. Length, 0.50 mm.; height, 0.27 mm.; thickness, 0.12 mm.

Navesink. Columbia University Coll. No. M18.

Cytherelloidea spiralia, n. sp. Pl. 6, fig. 2

Carapace compressed, small, inequivalved, subovate in lateral view; dorsal margin gently arched; anterior margin broadly rounded; ventral margin slightly concave; posterior margin less broadly rounded than anterior.

On the right valve a marginal ridge starts at the posterior dorsal contact, and running anteriorly, passes round the dorsal, anterior, ventral, and posterior margins; on reaching the posterior dorsal angle the ridge curves inwards and extends in an anterior direction within the marginal ridge, dying out in the anterior dorsal region. A broad shallow pit is located dorsally to the center; posteriorly the pit narrows and joins the groove extending around the carapace inside the marginal ridge; just ventral to the center a shallow groove parallels the ventral border which is succeeded ventrally by a low ridge which is terminated by and separated from the marginal ridge by the marginal groove.

The left valve differs from the right in that the marginal ridge starts at the anterior dorsal contact instead of the posterior dorsal contact and, extending round the anterior ventral and posterior margins, curves inward at the posterior dorsal angle and passes anteriorly along the hinge margin terminating near the anterior dorsal contact. The right valve is larger than the left. The overlap consists only of that part of the marginal ridge that extends from the anterior to the posterior dorsal contact. Length,

0.53 mm.; height, 0.31 mm.; thickness, 0.16 mm.

Mt. Laurel and Navesink. Columbia University Coll. No. M19.

Cytherelloidea williamsoniana (Jones) Pl. 6, fig. 5

Cytherella williamsoniana Jones, Mono. Cret. Entom. Eng. Paleontog. Soc. London. 1849, p. 31, pl. 7, figs. 26a-i.
Cypridina leioptycha Reuss. Haid. Natur. Abhand., vol. 4, pt. 1, 1851, p. 49, pl. 6, fig. 11.
Cytherelloidea williamsoniana Alexander, Univ. Texas Bull. 2907, 1929, p. 55, pl. 2, fig. 12.

Carapace subquadrangular, small, compressed; dorsal margin straight; ventral margin straight to slightly convex; anterior and posterior margins evenly rounded. Anterior margin bordered by a low ridge that dies out on the anterior portion of the dorsal and ventral margins. Two longitudinal ridges start opposite the anterior dorsal and ventral contacts and, extending posteriorly parallel to the dorsal and ventral margins, terminate in large tubercles which are connected by a small ridge. Length, 0.72 mm.; height, 0.42 mm.; thickness, 0.28 mm.

Mt. Laurel.

Suborder PODACOPA Sars

Family BAIRDIIDÆ Sars, 1887

Genus BAIRDOPPILATA Coryell, Sample and Jennings, 1935

Genotype.—*Bairdoppilata viticula* Coryell, Sample and Jennings, Amer. Mus. Nat. Hist., Nov., No. 777, 1935, p. 4, figs. 3-4.

Carapace medium in size, generally more than 1 mm. in length; bairdioid in lateral view; inequivalved, left valve larger than the right, overlap developed on all margins but strongest on the dorsal and mid-ventral contacts; surface smooth or finely punctate, ventral margin may carry a small frill.

The hingement of the left valve consists of a groove and an adjacent ridge on the straight dorsal contact which die out at or on the anterior and postal slopes. Just dorsal of the anterior and posterior angulations and beneath the curved overlap margin a short series of transverse teeth and sockets supported on a small

platform are found.

The hingement of the right valve consists of a bar-like ridge with a groove along its dorsal side which engages with the groove and bar on the dorsal contact of the left valve. A series of crenulate teeth occurs on the edge of the valve, which engage with the teeth found in the left valve.

The presence of the teeth separates this form from *Bairdia*. Material from the Navarro in Texas shows that the form described by Alexander as *Bairdia magna* should be assigned to *Bairdoppilata*.

Bairdoppilata viticula Coryell, Sample and Jennings Pl. 6, figs. 6a-c

Bairdoppilata viticula Coryell, Sample and Jennings, Amer. Mus. Nat. Hist., Nov., No. 777, 1935, p. 4, figs. 3-4.

Carapace short, bairdioid in lateral view; dorsal margin highly arched and angulated at the crest; the dorsal contact is angulated at the crest and again near the mid-posterior slope. The posterior acuteness lies below the line of midheight; and the anterior angulation projects forward at the line of midheight. The surface is strongly convex, with the greatest thickness of the specimen near the center. It is finely punctate with the punctæ scarcely showing along the crest of the convexity but conspicuously and closely spaced on the anterior half of the valve and somewhat more widely spaced on the posterior part of the valve.

A delicate, narrow, radially grooved and scalloped frill extends along the contact of the valves from the anterior and posterior angulations towards the center of the ventral margin. The maximum development is found on the ventral contact towards the anterior and posterior terminations, the frill tending to die out in the center of the ventral contact and towards the anterior and posterior angulations.

The dorsal articulating ridge and groove are typical; the construction of the platform bearing the teeth is lunate in outline and is better developed at the anterior than at the posterior. Length, 1.13 mm.; height, 0.75 mm.

Mt. Laurel.

Bairdoppilata delicatula, n. sp. Pl. 6, fig. 7

Carapace large, inequivalved, elongate and subtriangular in lateral view; dorsal margin arched, dorsal contact slightly curved; anterior margin broadly rounded; posterior margin slightly produced; ventral margin convex. Left valve overlaps the right throughout the entire margin, overlap slightly greater on the ventral margin. Greatest height central; greatest length slightly ventral of the center; greatest thickness central. Hingement typical of the genus. Length, 1.50 mm.; height 0.85 mm.; thickness, 0.60 mm.

Hornerstown. Columbia University Coll. No. M31.

Bairdoppilata pondera, n. sp. Pl. 6, fig. 9

Test large, inequivalved, subtriangular in lateral view; dorsal margin strongly arched; anterior margin broadly and obliquely rounded; ventral margin convex; posterior margin obtusely angulated. Left valve overlaps the right over the entire margin, overlap stronger on the dorsal and ventral margins. Greatest height central; greatest length slightly ventral of center; greatest thickness central. Hingement typical of the genus. Length, 1.15 mm.; height, 0.82 mm.; thickness, 0.70 mm.

This form resembles *Bairdoppilata magna* (Alexander) but has longer ventral and postal slopes and a stronger dorsal overlap.

Navesink and Mt. Laurel. Columbia University Coll. No. M32.

Genus BYTHOCYPRIS Brady, 1880

Bythocypris parilis Ulrich Pl. 6, fig. 8.

Bythocypris parilis Ulrich, Maryland Geol. Surv., Eocene, 1901, p. 117, pl. 16, figs. 5-8.

Carapace small, reniform; dorsal margin arched; anterior and posterior margins nearly equally rounded, the anterior end being very slightly more sharply rounded than the posterior; ventral margin straight to slightly concave; dorsal view subelliptical; left valve overlaps the right on the dorsal and the ventral margins; surface smooth. Length, 0.90 mm.; height, 0.45 mm.

Hornerstown.

Genus ANTIBYTHOCYPRIS, n. gen.

Genotype.—*Antibythocypris gooberi*, n. sp.

Test subreniform, inequivalved, right valve overlapping left; dorsal margin arched, posterior margin higher and more broadly rounded than the anterior; margin of the anterior dorsal slope of right valve is grooved and corresponding margin of left bears a small ridge; otherwise hingement is simple; surface of valves may be reticulated and ridged.

Antibythocypris gooberi, n. sp. Pl. 6, figs. 10a-e.

Test subreniform, inequivalved, dorsal margin arched, anterior margin rounded, ventral margin straight to slightly concave, posterior margin higher and more broadly rounded than the anterior; right valve overlaps the left on the dorsal, anterior, and ventral margins, the overlap is strongest on the dorsal and the ventral margins; the inner margin of the valves is separated from the margin on the anterior and the posterior by a fairly wide marginal area, the inner margin projects beyond the line of concrescence at the posterior end and coincides on the anterior end; the marginal areas die out dorsally and ventrally; the margin of the anterior slope of the right valve is grooved and the corresponding slope on the left valve has a small ridge which fits the groove; otherwise the hinge is simple. The posterior margin is bordered by a sharp ridge which dies out at the dorsal and ventral contacts; the surface of the valve is covered with coarse reticulations. Length, 0.70 mm.; width, 0.40 mm.; height, 0.43 mm.

Mt. Laurel and Navesink. Columbia University Coll. No. M30.

Family CYTHERIDÆ Baird, 1850

Genus BRACHYCYTHERE Alexander, 1933

Brachycythere alata (Bosquet) Pl. 6, figs. 11a-b

Cypridina alata Bosquet, Mem. Soc. Roy. Sci. Liège, vol. 4, 1847, p. 369, pl. 4, figs. 1a-d.
Cythere alata Bosquet, Mem. Comm. Carte Geol. Neerlande, vol. 2, 1854, p. 117, pl. 9, figs. 10a-d.
Cytheropteron alatum Jones and Hinde, Suppl. Mongr. Cret. Entom. Eng., Irel., Paleontogr. Soc. London. 1889, p. 34.

Cytheropteron saratogana Israelsky, Arkansas, Geol. Surv., Bull. 2, 1929, p. 10, pl. 2A, figs. 4a-c.
Cythere cornuta (F. A. Roemer) var. *gulfensis* Alexander, Univ. Texas Bull. 2907, 1929, p. 85, pl. 8, figs. 1, 2, 6.
Brachycythere alata Alexander, Jour. Pal. vol. 7, 1933, p. 207, pl. 25, figs. 15a-b; pl. 27, fig. 18.

Carapace in side view oblong, subquadrate, highest in front; height equal to about half the length; dorsal margin slightly convex to straight; ventral margin straight; dorsal and ventral margins converge slightly posteriorly; anterior margin broadly rounded, compressed, with a narrow flat marginal rim; it carries six or more teeth of varying degree of development; posterior end more narrowly rounded than anterior and obliquely truncated in the dorsal half; it carries five or more teeth that vary in their degree of development from specimen to specimen; valves bear strongly projecting, compressed, alaeform, lateral expansions on the ventral margins; the outer margin is nearly straight, the postal margin concave and the angle between the postal and lateral margins bears a spine. Hingement typical. Surface of valves smooth. Length, 1.0 mm.; width, 1.0 mm.; height, 0.52 mm.

Hornerstown and Navesink.

Brachycythere betzi, n. sp. Pl. 6, figs. 12a-c

Carapace large, inequivalved, subovate; dorsal margin straight; anterior margin broadly and obliquely rounded, the ventral portion being produced and irregularly spinose; ventral margin weakly convex, maximum convexity slightly posterior to the center; ventral portion of the posterior margin rounded, dorsal portion straight, truncating the curvature of the ventral part and forming an obscure angulation at about the center; the curved ventral part carries 3 to 4 stubby spines. Left valve overlaps the right distinctly on the anterior dorsal and posterior margins; anterior margin bordered by an irregular ridge bearing a few short spines and paralleled posteriorly by a shallow depressed area, both of which die out at the dorsal and ventral contacts; the posterior margin is bordered by a compressed almost flange-like area

which also dies out dorsally and ventrally. The valves are very convex, the maximum convexity being reached in the posterior ventral region, forming a flat ventral surface and giving a pyriform outline to the dorsal view and a triangular outline in anterior view. The surface of the valves is reticulate, especially the tumid portion, with the reticulations irregularly arranged over the surface; the flat ventral surface is ornamented with a number of longitudinal ridges. Length, 1.23 mm.; height, 0.95 mm.; thickness, 0.95 mm.

Hornerstown. Columbia University Coll. No. M33.

Brachycythere harlani, n. sp. Pl. 6, fig. 13

Carapace large, inequivalved, elongate, ovate in lateral view; maximum height well anterior to the center; dorsal margin arched and slightly truncate along the posterior slope; anterior margin broadly rounded; ventral margin faintly convex; posterior margin narrowly rounded and obscurely truncated in its dorsal part; left valve overlaps right on the entire margin about equally; convexity of the valves increases from the dorsal towards the ventral margin and from the anterior and posterior ends towards the center, giving a subtriangular end view. Anterior and posterior ends compressed; the maximum compression of the right valve is parallel to and a little posterior of the anterior contact, the actual contact forming an indistinct ridge around the anterior margin; surface of the valves minutely punctate. Length, 1.35 mm.; height, 0.70 mm.; thickness, 0.72 mm.

This form differs from *Brachycythere ovata* (Berry) in being more elongate, and from the other forms assigned to this genus in having a less arched dorsal margin.

Hornerstown. Columbia University Coll. No. M34.

Brachycythere jerseyensis, n. sp. Pl. 6, figs. 14a-b

Carapace small, inequivalved, subtriangular in lateral view and triangular in cross section; greatest height anterior to the center; dorsal margin arched and obscurely angulated; anterior margin broadly rounded; ventral margin slightly convex, maximum con-

vexity posterior to the center; posterior margin narrowly rounded and obliquely truncated through the dorsal half, ventral half ornamented with a few short spines; left valve overlaps right on the entire contact; anterior end of carapace compressed, maximum anterior compression in the right valve posterior and parallel to the contact, forming a low ridge round the anterior contact of the valves; posterior end of the carapace strongly compressed; convexity of the valves increases from the dorsal towards the ventral margin in lateral view and from the anterior and posterior ends towards the center; the maximum convexity is reached at the ventral margin slightly posterior to the center. The tumid ventral margin of the valves is ornamented with a low rounded ridge that tends to merge with the curvature of the valves anteriorly and is sharply cut off posteriorly. Surface of the valves ornamented with a number of irregularly placed pits. Length, 0.85 mm.; height, 0.51 mm.; thickness 0.60 mm.

Navesink. Columbia University Coll. No. M 35.

Brachycythere ledaforma (Israelsky) Pl. 6, fig. 15

Cytheropteron ledaforma Israelsky, Arkansas, Geol. Surv., Bull. 2, 1929, p. 8, pl. 1a, figs. 5-7.
Cythere acutocaudata Alexander, Univ. Texas Bull. 2907, 1929, p. 87, pl. 7, figs. 5-6.
Brachycythere ledaforma Alexander, Jour. Pal. 7, 1933, p. 206, pl. 25, fig. 9; pl. 27, fig. 20.

Carapace small, subovate, inequivalved; greatest height anterior to the center; dorsal margin arched, angled and nearly straight along the hinge contact; anterior margin is broadly rounded; ventral margin slightly convex; posterior margin acutely angled and obliquely truncated; anterior and posterior ends of carapace strongly compressed; convexity of the valves increases towards the center of the ventral margin, maximum convexity projects beyond the ventral contact in some specimens; surface of the valves smooth except for the ventral surface formed by the tumidity of the valves, this is ornamented with a series of longitudinal ridges, the furrows between the ridges have small pits in them in well preserved specimens. Hingement is typical of the genus. Length, 0.65 mm.; height, 0.37 mm.; thickness, 0.40 mm.

Mt. Laurel and Navesink.

Brachycythere ovata (Berry) Pl. 6, figs. 16a-b.

Cythereis ovatus Berry, Am. Jour. Sci. ser. 5, vol. 9, 1925, p. 484, fig. 15.
Cythere ovata Alexander, Univ. Texas, Bull. 2907, 1929, p. 87, pl. 7, figs. 10 and 13.
Brachycythere ovata Scott, Geol. Soc. Am., Bull vol. 45, 1934, p. 1153 (list).

Carapace large, inequivalved, elongate, ovate in lateral view; dorsal margin evenly arched; ventral margin convex; anterior margin broadly rounded and minutely spinose; posterior margin narrowly rounded and obliquely truncated. Surface of the valves strongly convex; posterior and anterior ends compressed; convexity increases from the dorsal to the ventral border and from the anterior and posterior ends towards the central portion of the ventral margin giving triangular cross-section to carapace; tumid central portion of the valves projects below the ventral contact of the valves; surface of the valve appears to be minutely punctate. Hingement typical of the genus. Length, 1.10 mm.; height, 0.65 mm.; thickness, 0.65 mm.

The form, though smaller than the ones described by Alexander, appears to agree in all other respects.

Navesink.

Brachycythere pseudovata, n. sp. Pl. 6, figs. 17a-b

Carapace large (1.10 mm.), inequivalved, elongate, ovate in lateral view and subtriangular in cross-section, greatest height almost central; dorsal margin arched and slightly angulated at the greatest height; anterior margin broadly rounded; ventral margin gently convex, maximum convexity slightly posterior to the center; posterior margin narrowly rounded and obliquely truncated through the dorsal half; anterior and posterior ends compressed; maximum compression of the anterior end of right valve posterior to the contact, forming a low ridge round the anterior contact; convexity of the valves increases from the dorsal to the ventral margin and from the anterior and posterior ends towards the center; the tumid center of the ventral margin projects below the contact of the valves; the left valve overlaps the right on the entire contact; maximum overlap on the dorsal margin near the center. Length, 1.10 mm.; height, 0.66 mm.;

thickness, 0.62 mm.

This form differs from *Brachycythere ovata* (Berry) in the central location of the greatest height and the angulation there; also the overlap is not uniform throughout the dorsal margin as in *B. ovata.*

Navesink. Columbia University Coll. No. M36.

Genus CYTHEREIS Jones, 1849

Cythereis bassleri Ulrich Pl. 7, figs. 1a-b

Cythereis bassleri Ulrich, Md. Geol. Surv., Eocene, 1901, p. 120, pl. 16, figs. 19-21;—Weller, Geol. Surv., New Jersey, Paleontology, vol. 4, 1907, p. 843, pl. 110, figs. 1-3;—Alexander, Jour. Pal., vol. 8, 1934, p. 219.

Carapace suboblong, greatest height at the anterior dorsal contact; posterior end compressed; dorsal margin straight; anterior margin broadly and slightly obliquely rounded and bearing fine spines; ventral margin straight; posterior margin more narrowly rounded than anterior and obliquely truncated in the dorsal half, ventral half carries 2-4 small spines; anterior margin bordered by a wide rounded ridge that tends to become obsolescent as it proceeds posteriorly from the anterior dorsal contact; the anterior dorsal contact is marked by a well developed node; a ridge starts at the anterior ventral contact and, curving slightly dorsally, parallels the ventral margin, increasing in size until it is abruptly terminated by the posterior compressed area; a less developed ridge rises at or near the anterior dorsal contact, and, running parallel to the dorsal margin, is also terminated by the posterior depressed area; the posterior ends of these ridges turn at an abrupt angle towards the center forming a J-shaped hook at the end of the ridge; the depressed area at the end of the carapace is bordered by a thickened rim which terminates against the raised portion of the valves; a strongly developed sub-central tubercle is present and the surface of the valves is covered with pits or reticulations, the spaces between which sometimes coalesce into raised sharp ridges especially near the center of the valves. Length, 0.85 mm.; height, 0.42 mm.; thickness, 0.40 mm.

Mt. Laurel and Navesink.

Cythereis bassleri var. **lata**, n. var. Pl. 7, figs. 2a-b

This form differs from the typical in that it is much shorter in relation to its height than *Cythereis bassleri*. Length, 0.75 mm.; height, 0.40 mm.; thickness, 0.42 mm.

Navesink. Columbia University Coll. No. M20.

Cythereis communis Israelsky Pl. 7, fig. 3

Cythereis communis Israelsky, Arkansas Geol. Surv., Bull. 2, 1929, p. 14, pl. 3a, figs. 9-13.
Cythereis communis Alexander, Univ. Texas Bull. 2907, 1929, p. 101, pl. 9, fig. 18.
Cythereis communis Scott, Geol. Soc. Am., Bull. 45, 1934, p. 1153 (list).

Carapace small, elongate, suboblong in lateral view, anterior end slightly higher than posterior; dorsal margin irregularly straight; anterior margin obliquely and broadly rounded, coarsely spinose on ventral third; ventral margin straight; posterior margin narrowly rounded and truncated obliquely on the dorsal half, ventral half ornamented with three or four coarse spines; posterior end of carapace compressed; anterior margin bears a broad rounded peripheral ridge which extends posteriorly along the dorsal and ventral margins; these ridges are abruptly terminated by the compressed posterior end; the ventral of these ridges attains a stronger development than does the dorsal and projects beyond the surface of the valves in an almost alate extension before it is terminated by the compressed posterior region. A third broad, less well defined ridge extends from the posterior compression along the mid-line of the valves dying out in the anterior quarter of the valves. The surface of the valves is sparsely punctate. Hingement typical of the genus. Length, 0.76 mm.; height, 0.38 mm.; thickness, 0.37 mm.

Mt. Laurel and Navesink.

Cythereis curta, n. sp. Pl. 7, figs. 4a-b

Test small, subrhomboidal, inequivalved, left valve larger than the right, overlap shows only at the anterior dorsal contact; dorsal margin straight; anterior margin broadly and obliquely rounded; ventral margin straight to very slightly convex; posterior margin angulated at about mid-point, ventral half curved, dorsal

half straight, truncating the curvature, curved portion bears a few small spines; posterior portion of valves strongly compressed. A ridge starting in the anterior ventral part of the valves curves outward to the ventral margin and extends in a posterior direction to the posterior ventral contact where it is terminated by the compressed area of the posterior portion of the carapace. A very poorly developed ridge borders the dorsal half of the anterior margin and extends to the dorsal posterior contact where it is terminated by the depressed area. An irregular, almost dendritic, oblique ridge occupies most of the center of the valves. It extends from the anterior ventral to the posterior dorsal region of the valves. The hingement is typical of the genus. Length, 0.55 mm.; height, 0.34 mm.; thickness, 0.34 mm.

Navesink. Columbia University Coll. No. M21.

Cythereis huntensis (Alexander) Pl. 7, fig. 5

Cythere huntensis Alexander, Univ. Texas, Bull. 2907, 1929, p. 88, pl. 6, fig. 12.
Cythereis huntensis Alexander, Jour. Pal. vol. 8, 1934, p. 236.

Carapace small, ovate, highest anteriorly; dorsal margin straight, sloping posteriorly; anterior margin broadly rounded and ornamented with spines on the ventral half; ventral margin very slightly convex; posterior margin narrowly rounded, denticulate, and slightly angulated.

The entire margin is surrounded by a rim that is most strongly developed round the anterior border. A sharp ridge rises near the anterior dorsal contact and curves ventrally and posteriorly, finally forming a longitudinal ridge that lies just dorsal to the median line. A second ridge rises near the anterior ventral contact and curving dorsally joins the median ridge; a third ridge rises near the anterior ventral contact, and curving upwards, extends posteriorly finally joining the dorsal longitudinal ridge; a fourth ridge starts at the posterior ventral contact and, extending anteriorly, forms the anterior marginal ridge for about 1/3 of the length and then curves dorsally to join the ventral longitudinal ridge. These ridges are joined by cross ridges that give

a fenestrated appearance to the surface of the valves. Length, 0.55 mm.; height, 0.32 mm.

Navesink.

Cythereis pulchra, n. sp. Pl. 7, fig. 6

Carapace subrectangular, inequivalved, compressed; greatest height at the anterior dorsal contact; dorsal margin straight; anterior margin broadly rounded, spinose, and slightly produced; ventral margin straight, the dorsal and the ventral margins converge posteriorly; posterior margin narrowly rounded and truncated in the dorsal half, three or four well developed spines on the ventral portion; posterior end compressed.

A marginal rim extends round the periphery; the anterior rim, sharp and well developed, is paralleled posteriorly by a depressed area containing two rows of strong oblong reticulations running parallel to the margin; at the anterior dorsal contact, the ridges between the rows of reticulations fuse with the marginal ridge, which extends posteriorly along the dorsal margin to the posterior dorsal contact; at this point the ridge divides, one part forming a J-shaped hook towards the center of the valves, the other part forming a low ridge round the posterior margin; the ventral marginal ridge is poorly developed and in some of the forms almost obsolete, amounting to but little more than a slight thickening of the edge of the valves; another ridge starts opposite the anterior ventral contact and, curving slightly dorsally in the first quarter of its length, runs parallel to the ventral margin and is terminated by the depressed area at the posterior end; the surface of the valves is coarsely punctate with the exception of the rows of reticulations round the anterior end. A round node is located at the center of the valves. Length, 0.76 mm.; height, 0.40 mm.; thickness, 0.35 mm.

Mt. Laurel and Navesink. Columbia University Coll. No. M22.

Cythereis wrighti Jones and Hinde Pl. 7, fig. 7

Cythereis wrighti Jones and Hinde, Suppl. Mon. Cret. Entom. of Eng. and Irel., Paleont. Soc. (1889) 1890, p. 25, pl. 4, fig. 18.

Carapace small, subtriangular; greatest height at anterior dor-

sal contact; dorsal margin straight; anterior margin broadly rounded; ventral margin straight; posterior margin more narrowly rounded than is the anterior and obliquely truncated through the dorsal half; ventral part bears 3-4 small spines; posterior part of the carapace compressed; anterior margin bordered by a ridge which is sharp at the ventral contact but which expands to a rounded swelling at the dorsal contact; ventrally a ridge parallels the margin, the anterior end merges into the curvature of the valve; posteriorly it is sharply terminated by the compressed part of the valves. The dorsal margin is paralleled by a ridge bearing 3-4 low rounded tubercles and, as in the ventral ridge, it is terminated abruptly at the posterior end by the compression of the valves and anteriorly by the curvature of the valves. Hingement typical for the genus. A distinct tubercle is located almost centrally, otherwise the surface of the valves is smooth. Length, 0.4 mm.; height, 0.35 mm. No complete specimens were found, and though the form differs from Jones' drawings in that the ventral ridge is smooth and not tuberculated, it agrees in other respects and is therefore referred to this species.

Mt. Laurel and Navesink.

Genus PARACYTHEREIS, n. gen.

Genotype.—*Paracythereis typicalis*, n. sp.

Carapace small, subquadrate, inequivalved. Left valve larger than the right; dorsal and ventral margins straight; anterior margin broadly rounded and spinose; posterior margin narrowly rounded and often truncate on the dorsal half; posterior end usually strongly compressed.

Surface of the valves ornamented with pits or reticulations, and ridges. Subcentral tubercle generally present.

Hingement in the right valve consists of a linear crenulate tooth at the anterior dorsal contact, a fine crenulate groove extends along the margin from the anterior tooth to the posterior dorsal contact; a large crenulate tooth is developed on the posterior margin at the posterior dorsal contact. The anterior margin carries a groove, the inner margin of which developes on the ventral margin into a thin ridge over which the left valve fits.

The hingement of the left valve consists of anterior and posterior sockets connected by a finely crenulate bar. A small ridge on the anterior margin fits the groove in the anterior of the right valve; the central portion of the ventral margin of the left valve laps over the ridge of the ventral portion of the right valve forming an internal overlap.

These forms have an outline resembling *Cythereis* but the difference in hingement sets them apart.

Paracythereis typicalis, n. sp. Pl. 7, figs. 8a-c

Carapace small, subquadrate, inequivalved; left valve larger than right; overlap conspicuous at anterior dorsal contact; anterior margin broadly rounded, posterior margin more narrowly rounded; both anterior and posterior margins finely spinose; posterior end of carapace compressed; surface ornamented with reticulations and a sharp subcentral node; hingement typical of genus. Length, 0.5 mm.; height, 0.35 mm.

Navesink. Columbia University Coll. No. M28.

Genus PSEUDOCYTHEREIS, n gen.

Genotype—**Pseudocythereis reticulata, n. sp.**

Carapace small, subquadrate, inequivalved; right valve overlaps the left on dorsal margin; strongest development in center of dorsal region; left valve overlaps right on ventral margin, strongest near center. The genus has a pyriform outline in dorsal view and the surface is strongly reticulate. The shell material is heavy. The line of concrescence and the inner margin coincide throughout. The marginal zone shows only at the anterior and posterior ends.

The hingement consists, as in *Cythereis,* of a knoblike anterior and posterior tooth, in the right valve. A well developed socket is located immediately posterior to the anterior tooth, and a shallow groove connects the anterior socket and posterior tooth. Corresponding to the anterior tooth and post-adjacent socket of the right valve, the left valve carries an anterior socket and a post-adjacent knoblike tooth. The anterior tooth lies below but is attached to the dorsal edge of the valve. The dorsal edge is elevated to form a ridge connecting the anterior tooth with a posterior

socket corresponding to the posterior tooth of the right valve.

The hingement is typical of *Cythereis*, but the outline especially of the pyriform dorsal view and the overlap features separate this genus from the forms assigned to *Cythereis*. It appears to the author that strong differences in outline and overlap are as valid generic distinctions as are hinge characters.

Pseudocythereis reticulata, n. sp. Pl. 7, figs. 10a-d

Carapace small, subquadrate, inequivalved; greatest height at the dorsal contact; dorsal margin slightly arched and obscurely angled at the center; anterior margin broadly rounded and finely spinose; ventral margin faintly convex; posterior margin is finely spinose and more narrowly rounded than the anterior; the maximum thickness of the valves is located posterior and ventral to the center of the valves. The surface tapers uniformly from the thickest point to the dorsal and anterior margins but is very steep in the posterior and ventral directions. The posterior end is compressed in such a fashion as to form a narrow flat border round the posterior margin. An indistinct oblique sulcus extends from the anterior ventral region to the posterior dorsal, the degree of development of this feature varies in the different specimens. Surface of the valves strongly reticulated; anterior and posterior margins paralleled by rows of oblong reticulations, two rows on the anterior and one row on the posterior end; the strongest development of the reticulations is found on the area of maximum thickness. Right valve overlaps the left on the dorsal margin; strongest development of the overlap near center. Left valve overlaps right on the ventral margin especially near the center. Hingement of the left valve consists of an anterior socket, a well developed tooth just posterior to the socket, a bar formed from the edge of the valve, and a posterior socket in the left valve. The right valve has an anterior tooth, a post-adjacent socket, and a posterior tooth connected with the anterior hingement by a groove. Length, 0.70 mm.; height, 0.35 mm.; thickness, 0.40 mm.

This form differs from the usual *Cythereis* form in outline but the hingement is the same. For that reason it is assigned to the

above new genus.

Mt. Laurel and Navesink. Columbia University Coll. No. M29

Genus CYTHERIDEA Bosquet, 1852

Cytheridea pinochii, n. sp. Pl. 7, fig. 9

Carapace small, inequivalved, subovate in lateral view; greatest height slightly anterior to the center; dorsal margin arched and obscurely angulated; anterior margin broadly rounded, sparsely and obscurely denticulated; ventral margin slightly convex in the center and slightly sinuous in the posterior third; posterior end narrowly rounded and truncated in the dorsal half; left valve overlaps the right on the entire margin, overlap slightly stronger on the dorsal margin; surface of the valves punctate, the strongest punctations arranged in a row slightly posterior to the center in a pronounced furrow. Length, 0.70 mm.; height, 0.45 mm.; thickness, 0.37 mm.

This form differs from *Cytheridea monmouthensis* in that the posterior end is not as acute as the one Berry describes and the wing on the posterior ventral margin is missing. Forms that resemble this were described by Alexander from the Cretaceous of Texas but they were even more angular at the posterior contact than were the forms illustrated by Berry.

Mt. Laurel. Columbia University Coll. No. M23.

Cytheridea punctilifera, n. sp. Pl. 7, fig. 11

Carapace small, inequivalved, subtriangular in lateral view; greatest height slightly anterior to the center; dorsal margin strongly arched; anterior margin broadly rounded; ventral margin straight; posterior margin narrowly rounded. Left valve overlaps the right on the entire periphery, overlap the least on the ventral margin, about equal on the others. Surface punctate; punctations in center of the valve arranged in two or three vertical grooves. Hingement typical. Length, 0.47 mm.; height, 0.30 mm.; thickness, 0.24 mm.

This form resembles *Cytheridea plummeri* Alexander but it is spineless and much more punctate.

Mt. Laurel and Navesink. Columbia University Coll. No. M24.

Cytheridea sepulchra, n. sp. Pl. 7, fig. 12

Carapace small, subovate, inequivalved; greatest height central, dorsal margin strongly arched; anterior margin broadly rounded; ventral margin gently convex; posterior margin narrowly rounded and truncated; greatest thickness ventral to the center. Left valve overlaps the right on entire margin, greatest on the dorsal and ventral margins. Surface irregularly punctate, the punctations in the center of the valves arranged vertically in two grooves with 6-7 to a groove. Length, 0.45 mm.; height, 0.35 mm.; thickness, 0.26 mm.

Mt. Laurel and Navesink. Columbia University Coll. No. M26

Genus LOXOCONCHA Sars, 1865

Loxoconcha minuta, n. sp. Pl. 7, figs. 13a-b

Carapace small, subquadrate, convex; dorsal margin straight, dorsal contact slightly depressed; anterior margin broadly and obliquely rounded, being slightly produced in the ventral part; ventral margin somewhat convex just anterior to the center, and curving upwards to the posterior contact; posterior margin rounded with only a slight development of the typical caudal process.

Valves strongly convex, greatest thickness ventral of the center; convexity of the valves projects below the ventral contact; anterior and posterior margins bordered by compressed areas. Convex portions of the valves reticulate; the reticulations are irregularly arranged in the central portion of the valves, marginal reticulations are arranged in rows parallel to the margins of the convexity of the valves. Length, 0.32 mm.; height, 0.23 mm.; thickness, 0.20 mm.

Mt. Laurel and Navesink. Columbia University Coll. No. M 27.

RANGE CHART

FORAMINIFERA	Mt. Laurel	Navesink	Hornerstown
Allomorphina halli			x
Anomalina clementiana	x		
Anomalina pinguis	x	x	
Arenobulimina malkinae			x
Arenobulimina cuskleyae			x
Arenobulimina footei	x		
Arenobulimina haffi	x		
Bolivinita crawfordensis			x
Bulimina referata	x	x	
Bulimina quadrata	R	x	
Bulimina reussi		x	
Buliminella fusiforma		x	
Cibicides mortoni			x
Cibicides padella		x	
Cibicides burlingtonensis			x
Cibicides neelyi			x
Clavulina insignis		x	
Dentalina communis	x	x	
Dentalina granti	x		
Dentalina confluens		x	
Dentalina legumen var. spirans	x		
Dentalina nana	x		
Dentalina raristriata		x	
Dorothia bulletta	x	x	
Elphidium cynicalis			x
Eouvigerina hispida	x		
Flabellina reticulata		x	
Frondicularia archiaciana		x	
Frondicularia clarki		x	
Frondicularia cuspidata	x		
Frondicularia lanceola	x	x	
Gaudryina rugosa	x	x	
Globigerina bulloides			x
Globigerina compressa			x
Globigerina cretacea	x	x	
Globigerina triloculinoides			x
Globigerinella aspera	x	x	
Globigerinella voluta	x	x	
Globotruncana arca	x	x	
Globotruncana fornicata	x		
Globulina lacrima var. subsphaerica	x		
Gumbelina globulosa	x	x	
Gumbelina tessera		x	
Gumbelina ultimatumida	x		
Gumbelitria cretacea	x	x	

(*Foraminifera*)	Mt. Laurel	Navesink	Hornerstown
Guttulina hantkeni	x	x	
Gyroidina soldani	x	x	x
Hemicristellaria ensis	x		
Hemicristellaria rancocasensis			x
Lagena hispida			x
Lagena sulcata var, semiinterrupta	x	x	
Lagena rostra	x	x	
Lagena adepta	x		
Lenticulina degolyeri		x	
Loxostoma plaitum	x	x	
Marginulina bullata	x		
Marginulina costata	x	x	
Marssonella oxycona	x	x	
Neobulimina canadensis		x	
Nodogenerina sagrinensis			x
Nodosaria fissicostata			x
Nodosaria latejugata var. carolinensis			x
Nodosaria paupercula	x		
Nodosaria radicula	x		
Nodosaria zippei		x	
Nonionella cretacea	x		
Polymorphina subrhombica			x
Pseudouvigerina triangularis			x
Pullenia quinqueloba	x	x	
Pulvinulinella exigua var. obtusa			x
Robulus aldrichi	x	x	
Robulus convergens	x		
Robulus navarroensis	x	x	
Robulus hookerae			x
Saracenaria acutauricularis	x		
Siphonina prima		x	
Spiroplectammina laevis var. cretosa	x	x	
Spiroplectoides rosula		x	
Spiroplectoides emmendorferi			x
Textularia cf. dibollensis			x
Uvigerina seligi	x	x	
Vaginulina gracilis var. cretacea		x	
Vaginulina webbervillensis	R	x	
Valvulineria nelsoni	x	x	
Ventilabrella carseyae	x	x	
Verneuilina bronni		x	
Verneuilina kurti		x	

OSTRACODES	Mt. Laurel	Navesink	Hornerstown
Cytherella moremani		x	
Cytherelloidea monmouthensis		x	
Cytherelloidea navesinkensis		x	
Cytherelloidea spiralia	x	x	
Cytherelloidea williamsoniana	x		
Cythereis bassleri	x	x	
Cythereis bassleri var. lata		x	
Cythereis communis	x	x	
Cythereis curta		x	
Cythereis huntensis		x	
Cythereis pulchra	x	x	
Cythereis wrighti	x	x	
Cytheridea pinochii	x		
Cytheridea punctilifera	x	x	
Cytheridea sepulchra	x	x	
Loxoconcha minuta	x	x	
Paracythereis typicalis		x	
Pseudocythereis reticulata	x	x	
Antibythocypris gooberi	x	x	
Bairdoppilata delicatula			x
Bairdoppilata pondera	x	x	
Bairdoppilata viticula	x		
Brachycythere alata		x	x
Brachycythere betzi			x
Brachycythere harlani			x
Brachycythere jerseyensis		x	
Brachycythere ledaforma	x	x	
Brachycythere ovata		x	
Brachycythere pseudovata		x	
Bythocypris parilis			x

PLATES

PLATE I

EXPLANATION OF PLATE I (28)

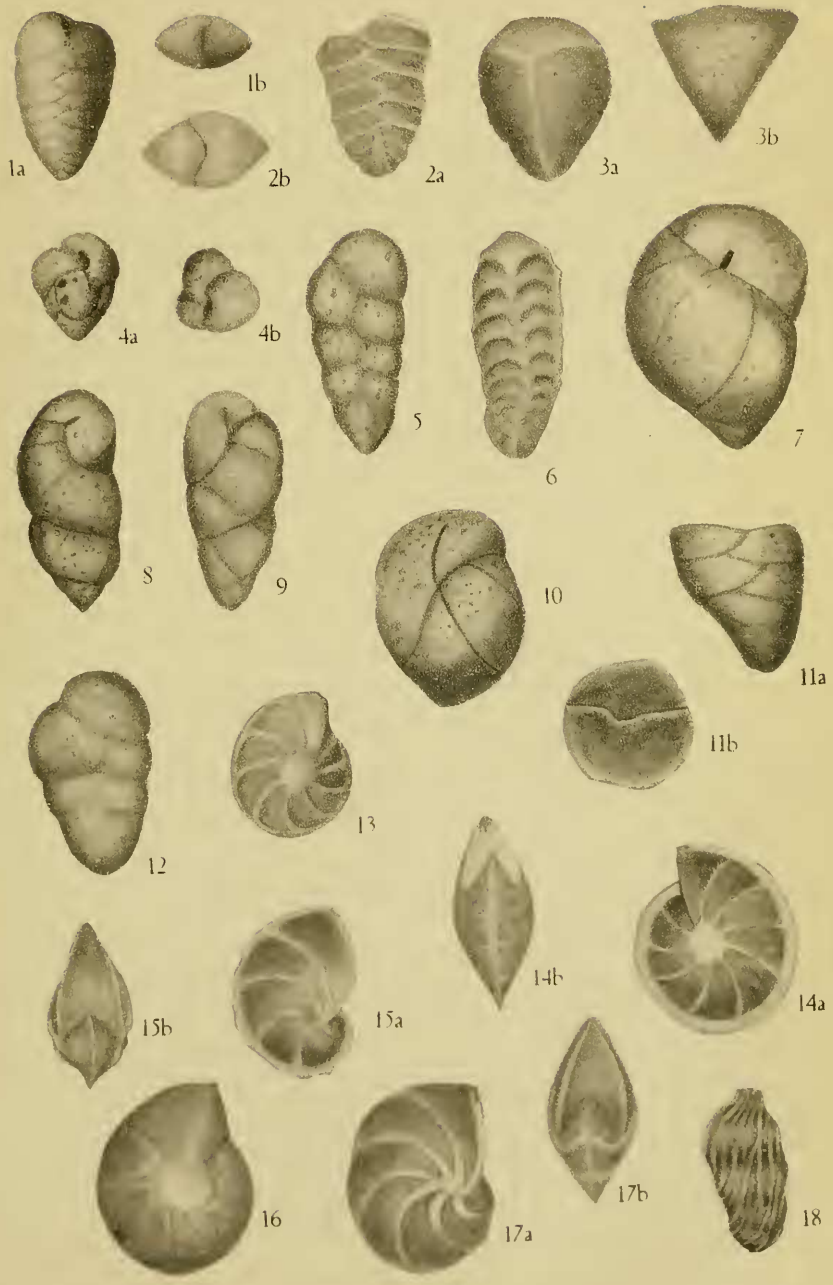

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PLATE II

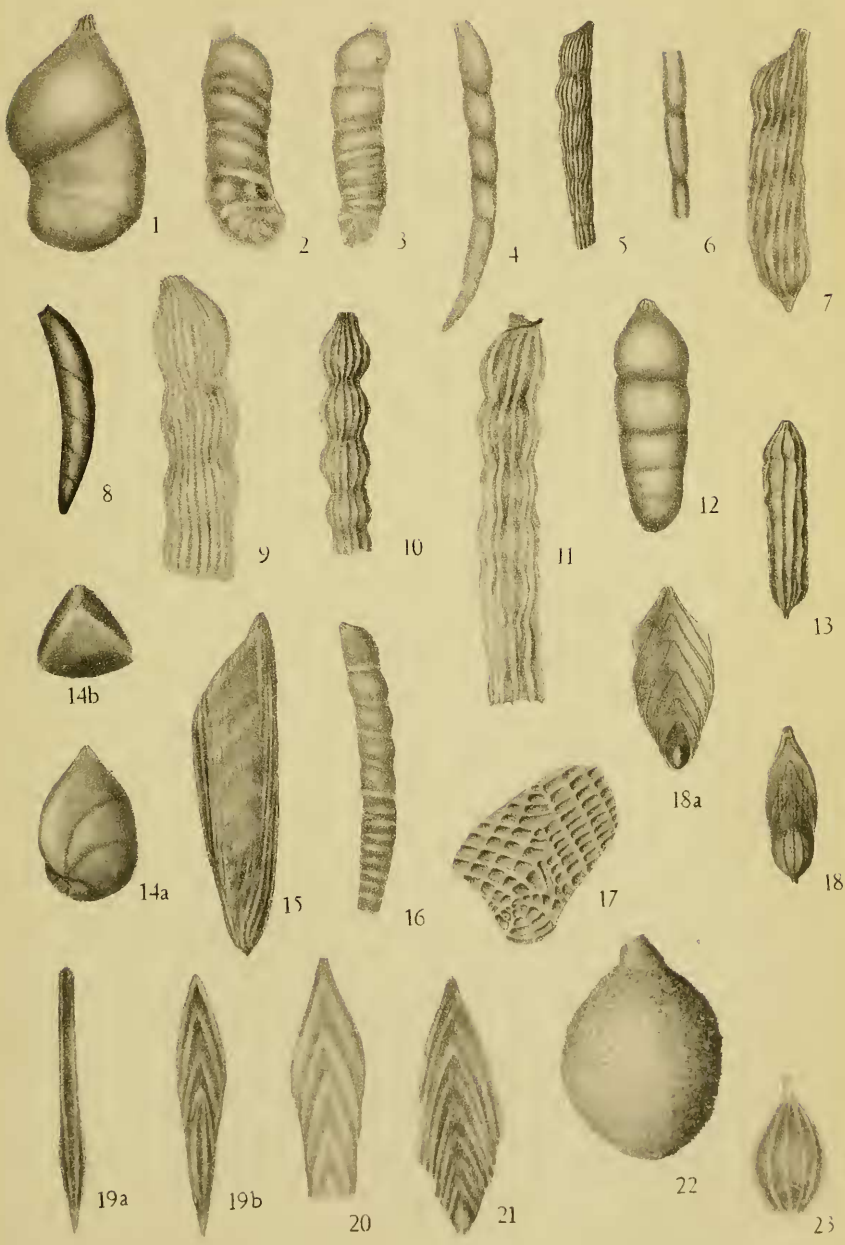
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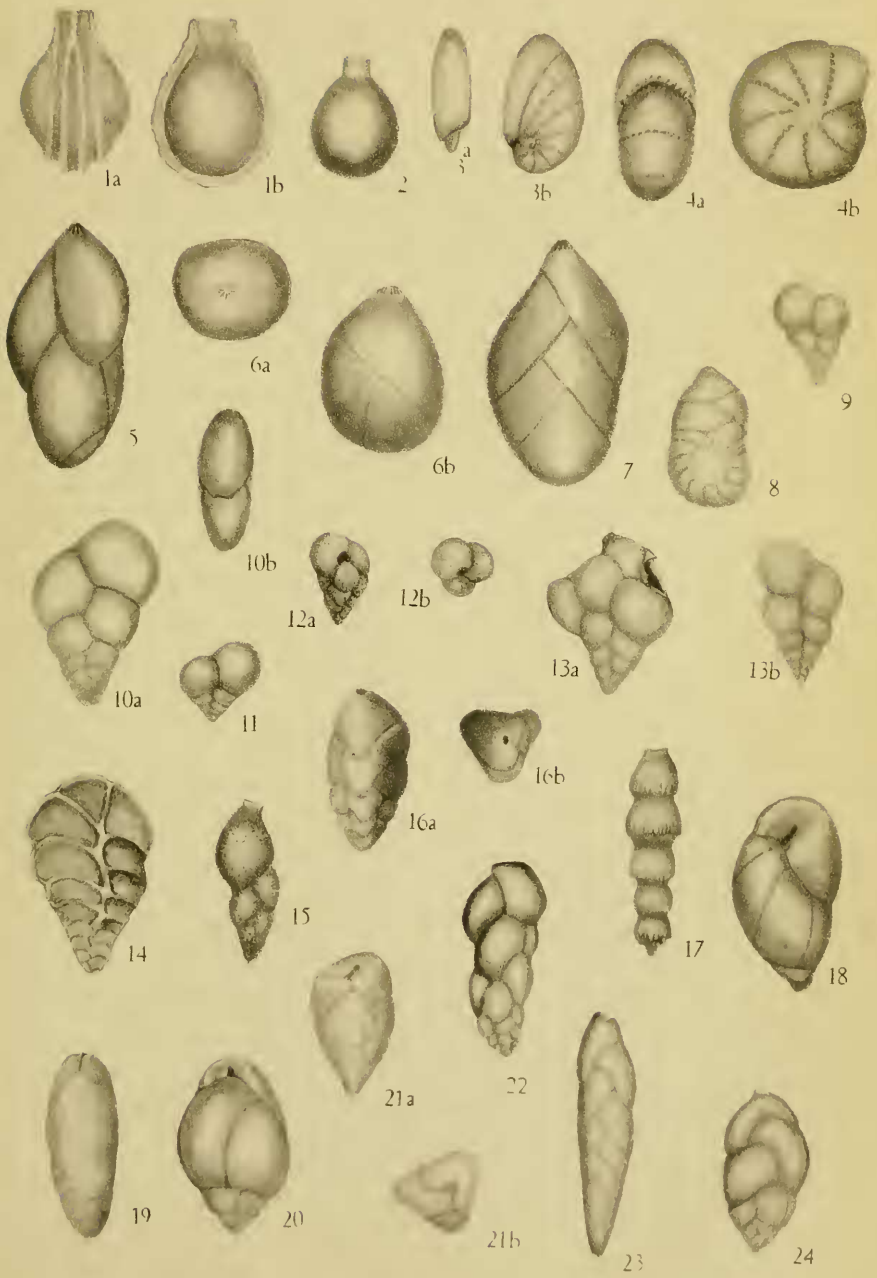
PLATE III

EXPLANATION OF PLATE III (30)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13b
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16a
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PLATE IV

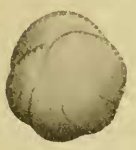
EXPLANATION OF PLATE IV (31)


1a


1b


2a


2b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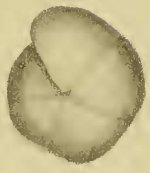
3b


4a


4b


5a


5b


6a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8


9


10


11


12


13


14a


14b

PLATE V

EXPLANATION OF PLATE V (32)

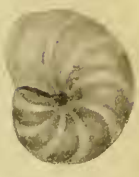
Figure — Page

1. **Anomalina pinguis**, new name X 65 — 37
2. **Anomalina clementiana** (d'Orb.), X 100 — 38
   a. Dorsal view, b. apertural view, c. ventral view
3. **Cibicides mortoni** (Reuss), X 35 — 38
   a. Dorsal view, b. apertural view, c. ventral view
4. **Cibicides neelyi**, n. sp. X 50 — 39
   a. Dorsal view, b. apertural view, c. ventral view
5. **Cibicides burlingtonensis**, n. sp., X 180 — 39
   a. Dorsal view, b. apertural view, c. ventral view
6. **Cibicides padella**, n. sp., X 180 — 40
   a. Dorsal view, b. ventral view

1

2a

2b



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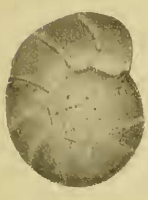

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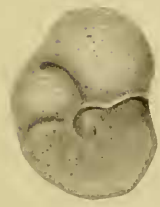
4a

4b

4c



5a

5b

5c

6a

6b

PLATE VI

EXPLANATION OF PLATE VI (33)

Figure — Page

1. **Cytherella moremani** Alexander, X 40. — 40
   Left valve
2. **Cytherelloidea spiralia**, n. sp., X 50 — 42
   Left valve
3. **Cytherelloidea navesinkensis**, n. sp., X 50 — 41
   Left valve
4. **Cytherelloidea monmouthensis**, n. sp., X 60 — 41
   Left valve
5. **Cytherelloidea williamsoniana** (Jones), X 45 — 43
   Left valve
6. **Bairdoppilata viticula** Coryell, Jennings & Sample — 44
   a. Right valve, X 20; b. interior left valve, X 36
   c. Interior right valve, X 36
7. **Bairdoppilata delicatula**, n. sp., X 16. — 45
   Right valve
8. **Bythocypris parilis** Ulrich, X 40 — 45
   Right valve
9. **Bairdoppilata pondera**, n. sp., X 20 — 45
   Right valve
10. **Antibythocypris gooberi**, n. gen., n. sp. — 46
    a. Left valve, X 30; b. dorsal, X 30; c. interior left valve, X 30; d. hinge right valve, X 40; e. hinge left valve, X 40
11. **Brachycythere alata** (Bosquet), X 25 — 46
    a. right valve; b. dorsal
12. **Brachycythere betzi**, n. sp., X 20 — 47
    a. Dorsal, b. ventral, c. right valve
13. **Brachycythere harlani**, n. sp., X 20 — 48
    Right valve
14. **Brachycythere jerseyensis**, n. sp., X 27 — 48
    a. Right valve, b. dorsal
15. **Brachycythere ledaforma** (Israelsky), X 25 — 49
    Right valve.
16. **Brachycythere ovata** (Berry), X 29 — 50
    a. Right valve, b. dorsal
17. **Brachycythere pseudovata**, n. sp., X 24 — 50
    a. Dorsal, b. right valve

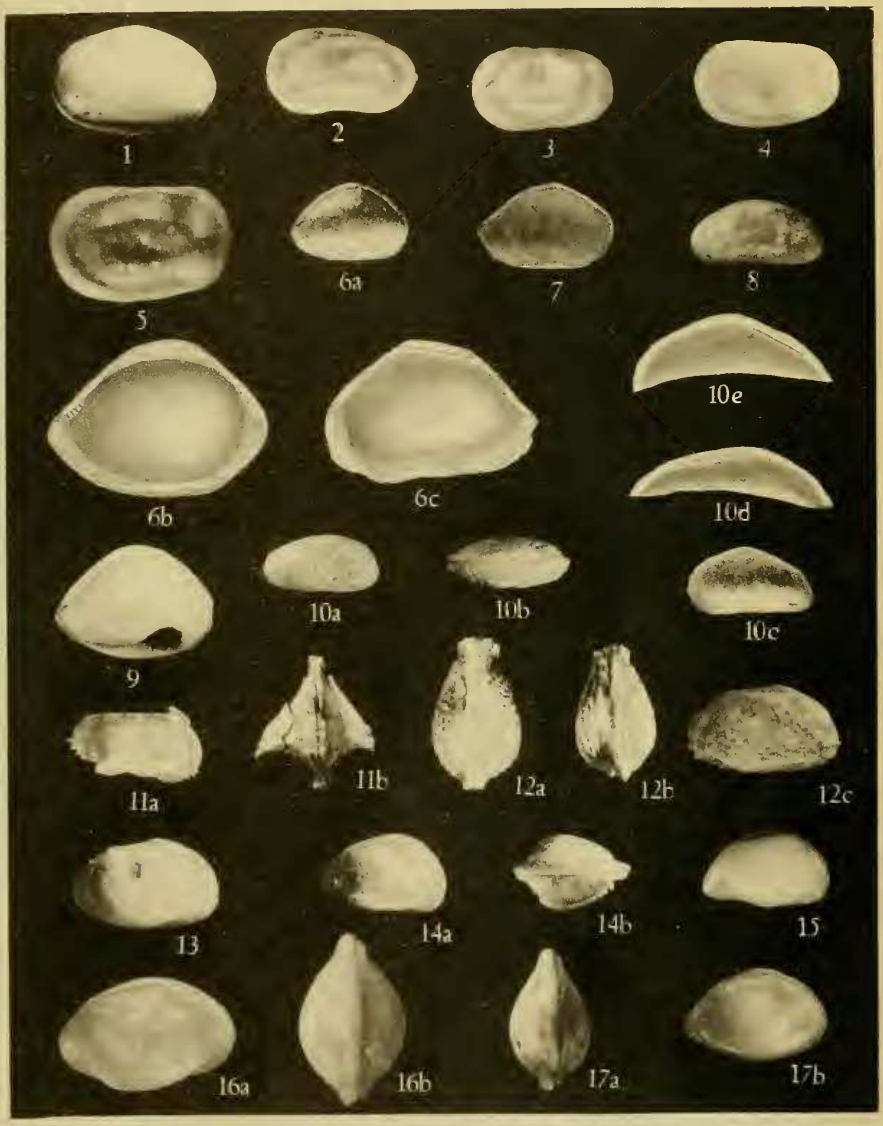

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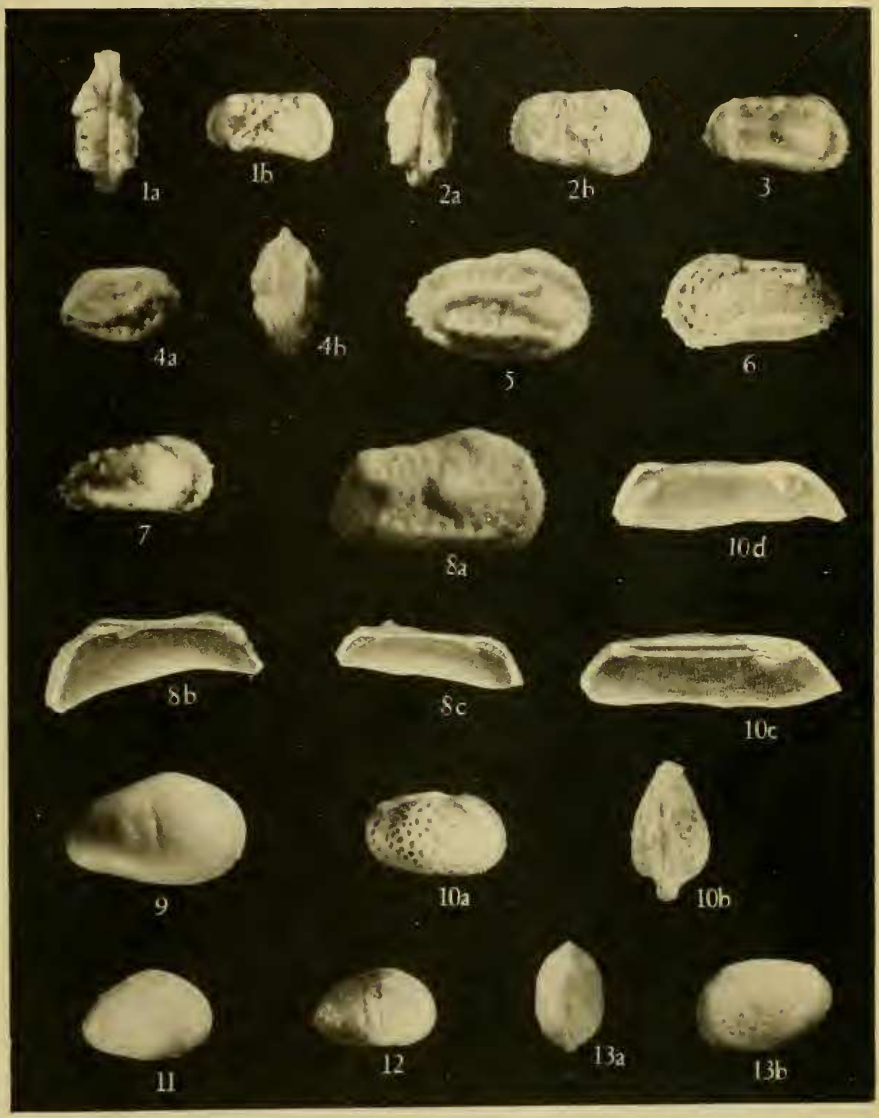
PLATE VII

EXPLANATION OF PLATE VII (34)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